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Major-General THE RIGHT HON. SIR HENRY STORKS, G.C.B.,
G.C.M.G., Comptroller-in-Chief, in the Chair.

AN ORGANIZATION FOR THE ARMY OF ENGLAND.

By Major J. BEVAN-EDWARDS, R.E.

Mr. Chairman, Ladies, and Gentlemen,

THE Council of this Institution has done me the honour to invite me to give a lecture on the subject of the "Reorganization of the Army." The subject has lately been much discussed in most classes of society, and by the press of this country. I feel great diffidence in undertaking so serious a task, but will endeavour to do so to the best of my ability.

About a year ago I gave much time and attention to the subject of the organization of the Army, and was induced to embody my thoughts in a pamphlet, solely intended for distribution amongst my military friends. I still adhere to the general principles on which my ideas were then formed, although to a certain extent the detail has been altered. I shall necessarily be obliged to give only a mere outline, as the time at my disposal will not permit of my otherwise treating so comprehensive a subject.

The present is a most opportune time for enquiring into the organization of our army. We cannot fail to perceive that there exists a general feeling of mistrust with regard to the efficiency of our military system, not in respect of the courage and discipline of our individual battalions, or of any of the component parts of our Army, but of its general want of fixed system and organization, which does not allow of our using to the greatest advantage, the armed forces now maintained by this country. I hope, in laying a scheme before you, to be able to point out that our armed forces may easily be placed in a condition to defend the country in case of invasion, and also to give the means for providing larger and more perfect expeditionary armies than we have hitherto despatched from our shores.

At the present time the empire has 620,000 men under arms, consisting of the regular army 200,000, the militia and yeomanry 130,000, the volunteers 170,000, and 120,000 regular native troops. It seems incredible that this country, with a force of 620,000 men under arms, can only put an army of 30,000 or 40,000 men into the field.

Let us enquire how we should be situated, and what we should do, if the country were threatened with invasion. We should call out our militia, yeomanry, and volunteers, but before they could become of any use they would have to receive an organization corresponding to that of a regular army. A mass of troops would, for the first time, be brought together, consisting of the regular army, pensioners, militia, yeomanry, and volunteers, without any proper proportion between the different arms of the service, and scarcely any field artillery. The present army would become the nucleus for the formation of *corps d'armée*, the infantry of each composed of a few battalions of the regular army, and a proportion of regiments of militia and volunteers. The remainder of the militia and volunteers would garrison our fortresses and coast batteries, and the militia and volunteer artillery, with the regular garrison artillery, would man the guns. The army in the field thus composed would consist of from 150,000 to 200,000 men, divided into corps of 20,000 or 30,000 men each. The infantry of this army would be indifferently armed, but in a tolerable state of discipline, and the cavalry, augmented by the yeomanry, would be in a fair proportion to it. The other branches of the service would, however, be quite insufficient. At the lowest calculation the field artillery should number 450 or 600 guns, a force four or five times greater than we could command, and it would be almost without all the services that render an army capable of moving, such as the military trains and pontoon equipments. The officers of the staff, hastily got together, though admirably educated for their duties, would nevertheless be found inefficient from the absence of system and previous practice. Conceive the confusion and waste of strength that must ensue. Such an army might occupy a defensive position prepared beforehand, but if it were compelled to manœuvre in front of an invading enemy it would inevitably be broken up and destroyed, no amount of discipline in the few regular battalions, no individual gallantry and intelligence could save it from disaster—nothing could supply the want of organization. To make our bodies of armed men of any use for such a contingency, it is absolutely necessary that they should receive an organization in time of peace; and as it will not put the country to any additional annual expense, there appears no reason why they should not receive it. It would give confidence to the nation, and save it from those periodical invasion panics which have made us so ridiculous in the eyes of Europe.

In the second place, how are we prepared to send an expeditionary force on active service, such as that to Turkey in 1854? Under our present system we should have to despatch our soldiers (for I will not call it an army) from this country by battalions, regiments of cavalry, and batteries of artillery, thereby necessitating the occupation of a safe point near the enemy's frontier, in order first to

organize an Army out of the various component parts there collected, before we could be in a position to undertake any hostile operations.

It happened during the Russian war at Gallipoli, and afterwards at Varna. Supposing, however, that ample time was given, it is evident that no army formed under such circumstances could be really efficient. We should have a repetition of the great expenditure of the lives of our soldiers and the national money which occurred during the first part of the Crimean war.

We may take it for granted that, after providing for our colonies, our Army should be organized to resist invasion, and, so far at least as its numbers will permit, be able to despatch perfect expeditionary armies, thereby giving security to the country, and saving enormous expenditure in time of war.

In originating a scheme, I have endeavoured to keep the following conditions always before me. To cause no additional annual expenditure; to introduce only those changes which appear absolutely necessary; to leave existing interests undisturbed; to allow of our Army being reduced to the smallest possible limits in time of peace, consequently maintained at the smallest possible cost to the country; and to be sufficiently comprehensive to embrace all our various military bodies, enabling our Army in India to be more readily available for the general service of the Empire.

The scheme which I shall now lay before you deals only with the combatant branches, but I may venture to say that the new Comptroller-in-Chief will find it far easier to organize the non-combatant branches to meet its requirements, than to accomplish the task he now has before him, as at present he has no basis to work from.

With the present strength of our forces, we ought to be able to place in the field for the defence of the country, at the shortest possible notice, an army of 180,000 or 200,000 men, perfect and complete in all its various component parts. It is customary in these days to talk of armies of great numerical strength, but among the vast armies of the Continent, how seldom do we find in the field, at one point, a larger army than this. We have the men for such an army ready in this country, and they only require an organization in time of peace to make them available in time of war.

The following steps appear indispensable:—

1st. To concentrate the Army to a greater extent in the United Kingdom.

2nd. To divide it into *Corps d'armée* of equal strength, and distribute it with reference to them.

3rd. To organize the militia and yeomanry, so that they can readily join the regular *Corps d'armée*.

4th. To give to the field artillery an organization which will render it capable of rapid expansion.

5th. To form dépôts for the establishment and instruction of a reserve of trained men for the different services.

1st. "To concentrate the Army to a greater extent in the United Kingdom," or, in other words, to make it more an imperial than a

colonial army. This is necessary for the purpose of establishing in the United Kingdom, a nucleus for the formation of a larger and more efficient regular Army than we have at present.

On the 1st January, 1868, the regular Army consisted of some 200,000 men, the combatant branches of which are divided into—

- 148 battalions of infantry.
- 31 regiments of cavalry.
- 31 brigades of artillery, viz.:—
 - 6 brigades of horse artillery.
 - 8 do. field.
 - 14 do. garrison.
 - 3 do. of mixed field and garrison.
- 30 companies of engineers.
- 1 troop of engineers.
- 24 troops of military train.

Not to go too much into detail, let us only consider the distribution of the infantry, as the other services should generally be proportioned to it. There are 52 battalions of infantry on the Indian establishment, and 96 on the British establishment, the former paid for by India, and the latter from the revenues of this country. Of those on the British establishment there are 53 at home, and 43 in the colonies, so that with the regiments in India, 95 are on foreign service, and 53 on home service. But 7 of these latter are battalions of guards, who, as a general rule, do not take colonial service; so that there are only 46 at home to relieve 95 in the colonies. Thus, in time of peace, a soldier passes rather more than two years abroad to every year he does at home. If it is desirable to shorten the term of foreign service, it can be done with the present strength of our Army, by decreasing the number of battalions in our colonies; but if any particular colony requires more men, the strength of the battalions in that colony may be increased very considerably. The 95 battalions abroad are thus distributed: 52 in India, 11 in the Mediterranean, 18 in North America and the West Indies, and the remaining 14 at the Cape, New Zealand, Australia, Mauritius, and China.

There are two classes of colonies; the one, such as Australia, New Zealand, the Cape, and the North American is representative and self-governing. These colonies are virtually independent of the mother country, but we have a right to expect from them a certain amount of assistance, either in men or money, so long as they claim imperial protection. Where this is required on land, they must establish a powerful and well-organized militia to co-operate with our regular army. This case especially applies to the North American group, as these colonies are in immediate contact with a large and powerful nation, with whom they may some day be at war. Australia, New Zealand, and the Cape, not being placed in a similar position, do not require to maintain large forces of militia, they need only be prepared to protect themselves from naval attacks, or hostilities with their native tribes. In time of peace, the imperial garrisons are unnecessary in

these colonies, except where they are required to garrison one or two naval fortresses for imperial purposes. The very few battalions that are now stationed in them could be of little use in time of war without considerable reinforcements.

The other class of colony consists of Gibraltar, Malta, Aden, Bermuda, Mauritius, and Hong Kong. These are chiefly kept as naval arsenals and coaling stations. We are to a great extent, dependent upon them for the maintenance of our command of the seas, and consequently our naval supremacy, and for the safety of our mercantile marine, when we are at war with a powerful maritime nation. No expense or care should be spared in strengthening these colonies. They should be fortified and strongly garrisoned, and protected by every means in our power. If we reduced the garrisons of our representative colonies, we could bring to this country at least

6	battalions from North America,
3	„ the Cape,
3	„ New Zealand and Australia,

and I hope to show that by doing so, we should be in a better position than we are at present to provide for their defence in time of war. The number of regiments at home would then be 58, exclusive of the Guards, and there would be only 83 abroad, instead of 95 as at present.

The second step is to divide our regular army into *corps d'armée* of equal strength, and to distribute it with reference to them.

The Administrative units of an army vary according to different circumstances, and may be as in ours, a battalion of infantry, regiment of cavalry, or battery of artillery. The Tactical unit is much the same for all modern armies, it is called a *Corps d'armée*, composed of all arms of the service, infantry, cavalry, artillery, engineers, and trains in proper proportion to one another. If the Tactical units are not properly maintained in time of peace, it is impossible that an army can be effective in time of war. The Administrative units may remain as they are at present, but Tactical units must be formed, if we require our army for any other purpose than that of finding small garrisons for our colonies.

Some time since a committee of officers assembled to consider the "equipment and supply of an army in the field," but they were first obliged to decide the relative strength of the different branches of the army, or what should be in short, the Tactical unit. They came to the conclusion that it should be a *Corps d'armée* of about 16,000 men, composed as follows, viz. :—

12	battalions of infantry,
3	regiments of cavalry,
12	guns, horse artillery,
36	guns, field artillery,
3	companies of engineers,
1	troop of engineers,
8	troops of military train,

divided into two divisions, and each division into two brigades, the cavalry forming a separate brigade.

Now as this *corps d'armée* appears suitable to our army, we will take it for our Tactical unit. Our present regular army would form 12 corps of this strength; and 5 of these I propose to allot to India.

We will now consider how the different arms of the service are proportioned to attain this object.

First, the infantry. At present we have seven battalions of guards, and 141 battalions of line, in all 148. For the 12 corps, we require 144; 4 battalions of infantry might therefore be reduced.

Next the cavalry; we have 31 regiments. Cavalry (and also horse field artillery and military train) is only required for 11 *Corps d'armée*, because the corps which garrisoned the Mediterranean fortresses would not need any. The number of regiments therefore necessary for the 11 corps would be 33; two additional regiments therefore are required.

We now come to the horse artillery, which, like the cavalry, is only required for 11 corps. In considering the number of guns, it must here be stated, that the batteries of horse and field artillery in India will need twice as many guns as those on the British establishment, the reason for which will be explained when we come to the distribution of the different *corps d'armée*; so that we shall want in all for our 11 corps, about 192 guns; at present there are 180.

The proportion of guns of field artillery required for a corps is 36. Giving double this number to each of the 5 corps in India, we require for the 11 corps 576 field guns. We have, now, I believe, about 468.

The next service, viz., that of the Engineers, requires 3 companies and 1 troop for each *Corps d'armée*; the army in India employs native sappers, so the remaining 6 corps require 18 companies and 6 troops. These are for service with the *corps d'armée* in the field, and not for sieges, as, on account of the various duties which engineers are then called upon to perform, these numbers are not sufficient. At present we have 30 companies and 1 troop.

Lastly; the military train. The complement is 8 troops for a corps, so our 11 corps require 88. At present there are only 24, but 40 of these additional troops would be maintained by India for the 5 corps in that country. These troops according to our present system, are made up to a strength of about 140 men each when on service, giving in all about 1,100 men, scarcely one-third of that which is considered necessary in the Prussian army.

It appears then that the different arms of the Service required to form our Army into 12 corps are proportioned thus. The infantry have 4 more battalions than are necessary. Of cavalry, there are 20 regiments on the British establishment, and as we should only want 18, there would be two to spare. These would, however, be required by India. The horse artillery would require 12 additional guns, 6 of these being for the Indian establishment. The field artillery would have to be augmented by about 108 guns, 66 of these for the British establishment, and the remainder for India. The strength of the engineers should be increased; and the military train would have an addition of 64 troops, of which only 24 would be wanted for the British establishment, and the rest for India. Thus we should have a reduction, on the British establishment, of about 3,500 men, and an increase

of about 6,000 for the field artillery, military train, and engineers, leaving a balance of increase of 2,500. These men can be obtained without extra cost, by a corresponding reduction in the infantry battalions, which, when occasion requires, can be augmented with much greater facility than the other services can be created.

The 12 *corps d'armée* would be distributed as follows, viz. :—

5 in the United Kingdom,
 1 in the Mediterranean,
 1 in North America and the West Indies,
 5 in India, with portions of a corps at the Cape, Mauritius, Ceylon, Singapore, and China.

The 5 corps in the United Kingdom, when made up to their full strength, would give an army of 80,000 men, ready at a very short notice for service in the field abroad; the home garrison being taken up by the militia.

The ordinary distribution of the 5 corps at home might be as follows :—

1st Corps, of whom the guards would form a considerable portion, in and around London.

2nd Corps in the south-eastern district, at Dover, Shorncliffe, Chatham, &c.

3rd Corps in the south-western district, at Portsmouth, Plymouth, Winchester, and including the permanent barracks at Aldershot.

4th Corps, a division in the western district, and a division in the northern.

5th Corps in Ireland.

The garrisons of Malta and Gibraltar would require the strength of a corps, and would have a division and head-quarters, say at Malta, the other division being at Gibraltar. The corps in North America and the West Indies should be thus distributed, viz., a division in Canada, a brigade in Nova Scotia and New Brunswick, and a brigade in the West Indies and Bermuda, to which the native West Indian regiments should be attached.

With reference to the 5 corps in India and the other Oriental colonies; the following are some of the chief reasons for including all these latter with India.

1st. To suit the general scheme for this organization.

2nd. In respect to the garrison of colonies within the tropics, experience shows that wherever European soldiers are so employed, there should be with them at least an equal number of native troops to perform those duties which entail such heavy losses upon Europeans, and which natives can discharge without detriment. If this had always been done, we should not have so lately witnessed the great loss sustained by a British regiment at Hong Kong. I was in China when it took place, and I know that the duties they were called upon to perform could have been done more efficiently by a regiment of native troops, and at a great saving of expense to the country. Native troops should then be employed at all stations within the tropics, and India is the country from which they might most readily

be obtained. They should only be to save the European, not to supersede him.

3rd. In the event of England being engaged in a war with a powerful maritime nation, it would be necessary to place considerable garrisons in Hong Kong, Singapore, and Mauritius, in order to guard our docks, naval depôts, and coaling stations, and to enable our fleets to keep the sea and protect our commerce. The reinforcements for these garrisons should come from India, which would be the base for their defence, England being too far distant, and it may be presumed, having already quite enough on her hands.

4th. The expeditionary corps required from time to time for our wars with China, Japan, or, as at the present time, with Abyssinia, would be more readily supplied from India than from this country.

These considerations should be taken into account in devising a scheme for the organization of our Army in India. The five corps in India should be incorporated with the Native Indian Army, and their strength would then be doubled by adding to them an equal proportion of natives. Thus each corps would consist of

24	{	12 Battalions of European Infantry.	
		12 do. " Native do.	
6	{	3 Regiments of European Cavalry.	
		3 do. Native do.	
24		Guns of Horse Artillery.	
72		do. Field do.	
		6 Companies of Native Sappers.	
		8 Troops of Military Train (double strength).	

Each corps would be divided into two divisions, each division into two brigades, the Cavalry forming a brigade. A considerable portion of the Native Indian Army might be absorbed in this way,* especially if each Native battalion were made up to a strength of 1,000 men. To give a proper proportion of artillery, there should be eight guns to a battery, and the men required to make up the necessary numbers above the European strength, might be natives: this, to a certain extent, was the case formerly, as the drivers of a battery of artillery were natives. Such an organization as this would have been found most advantageous during the present Abyssinian campaign. When it was decided on that an expedition should be sent, and as soon as its strength was determined, it would only have been necessary to have ordered a division of the Army, near the port of embarkation, to prepare for active service, and every one connected with it would have known what was required of him; the nucleus for the military train would have existed, and might have been temporarily reinforced from other divisions without having to create, in time of emergency, the land transport corps, of which we have heard so much lately. Under this head alone, the saving of expense in the Abyssinian Expedition would have been sufficient to cover the cost of maintaining the nucleus of military train for the corps in India for a considerable time. This body of military train would have enabled the expedition to have proceeded on its march with only just sufficient delay to

make the roads practicable. Had the expedition been formed of one of these divisions of the Indian Army, it would have consisted of a body of men accustomed to work together, instead as at present, of detachments from so many different corps.

The present distribution of the army in India would readily accord with that of the five *corps d'armée*, but one of them would have to find half a brigade for China, half a brigade for Ceylon and Singapore, and a brigade between the Cape and the Mauritius.

At the present moment, there are 52 European regiments in India, so that with two in China, two in Ceylon and the Straits Settlements, two in the Mauritius, and two at the Cape, we should have 60 battalions, the number required for five *corps d'armée*. With this organization, suppose at any time we want an army for service, such for instance as that which was sent to assist Sir Ralph Abercrombie, a *corps d'armée* of 32,000 men could be dispatched on the shortest possible notice, perfect and complete in all its different requirements; whereas, under the present system, a great length of time would be required to get such a body of men ready to take the field, and with a certainty of the expedition breaking down, because it would be necessary to create for it in time of war, an organization that should have existed to a great extent, in time of peace. This then is the secret of our numerous failures in sending expeditions on active service.

If it is difficult to extend the corps organization to that portion of our army in the colonies; the army in the United Kingdom and in India should at all events be divided into tactical units or *corps d'armée*, then the garrisons of the colonies would remain as at present, with the exception of the withdrawal of 12 battalions from the representative colonies; the reliefs of the army being carried out as heretofore. I do not anticipate that this scheme "for the organization of our regular Army" could be carried out without some difficulties to be overcome, but the want of a general plan is so urgent as quite to over-balance them, and the necessity for it will be more apparent when we consider the next proposition—which is the most important for the defence of our country, viz. :—

To organize the Militia and Yeomanry so that they can readily join the five regular *corps d'armée* in the United Kingdom. This is rendered necessary, because, with the present organization, the Militia and Yeomanry cannot act efficiently with the regular Army. Every battalion of Militia and regiment of Yeomanry should belong to some *corps d'armée* of the regular Army, and occasionally be trained with it in time of peace. The plan I propose, will enable these five *corps d'armée* to be at once doubled and raised to an effective strength of 160,000 men.

The Militia Infantry now consists of 135 battalions; this number of battalions is more than is required for the actual garrison duties of the United Kingdom; after reserving a sufficiency for these duties, therefore, let us give the remainder an organization that will enable them at once to join the regular Army. On account of the increased means of communication by railway and steam, there is no longer that necessity, which formerly existed, for scattering the head-quarters of the regiments so much. I therefore propose to take the 135 battalions, and, without

increasing the total number of men, to make 60 regiments, each of three battalions; the first battalion to join the regular Army; the second to perform garrison duties, and the third, as a *dépôt* battalion, to form a reserve for the instruction of recruits before they join the first or second battalions, and also to enrol on their strength large bodies of men as reserves for every service, who would be available when required. This could be carried out in the following manner. Take the men most willing to serve and undergo more efficient training, and put them into the first battalions, and let each of these battalions be 1,000 strong—in all 60,000 men. In the second battalions place those men who, from various causes, are unable to give up so much of their time for training; and if each of these battalions consisted of 600 men, they would be sufficient for the ordinary garrison duties. These second battalions would then require 36,000 men; but if the pensioners, 15,000 strong, be incorporated with them, then they will only require 21,000 men, or 81,000 for the first and second battalions.

In the third or *dépôt* battalions, I would place the twelve years' service men, who now form the new "Army of Reserve," and also the "Militia Reserve," because from the former we might obtain the drill instructors which we require for our recruits. They should also have men enough to fill up the ranks of the regular Army in time of probable invasion. For this purpose, inducements should be held out to men to enrol themselves on their strength and go through a course of instruction; and these men should be enlisted on the understanding that they were to serve in the regular Army in the event of invasion. All recruits, before joining the first and second battalions should receive their training in these *dépôt* battalions, and be thus fitted at once to take their places in their regiment. The first battalions should be broken up as little as possible, in time of war, by men volunteering for service into the regular Army, as that is the time when they are required to be most efficient.

With regard to the Yeomanry, I would adopt a somewhat similar system. At present it consists of 48 corps, numbering about 14,000 men. The present organization of these corps and their limited periods of training will not allow of their acting efficiently with the regular Army. I propose that it should consist of 15 corps, each corps of 2 regiments. Like the first battalions of militia, the first regiments of each corps might be composed of men to serve with the 5 regular *corps d'armée*, and give up more time to their annual training. The second regiments should consist of men who could only give the limited time for training which they do at present, but they would be available for garrison duties if called upon. The first regiments should be about 650 strong, and the second 300; the former would give the means of doubling the cavalry of the 5 *corps d'armée* when required, 3 regiments to each corps.

By effecting this change in the organization of our militia and yeomanry, we could find men at any moment to double the strength of the regular Army in the United Kingdom; but it would be necessary for the efficiency of the whole, that they should sometimes join the regular *corps d'armée* in time of peace. For this object camps should

be occasionally formed for the instruction of the different corps, and the militia and yeomanry should join for a short time their *corps d'armée*, and be attached to the brigades of infantry and cavalry to which they belong, raising the corps almost to its strength to resist invasion. Thus the *corps d'armée* in the London district might be encamped on some convenient site south of the Thames, and be joined by its militia and yeomanry, whilst that in the south-western district would encamp on some of the large heaths or commons in Hampshire, and the corps in the south-eastern district, in West Kent or Sussex. Each of these *corps d'armée* would represent at its full war strength, 32,000 men, and the three might march to a central camp for a short period, forming an army representing 96,000 men, and afford the generals and staff some practice in moving large bodies of troops. The *corps d'armée* in the other districts might occasionally encamp in smaller bodies—by divisions, or brigades at least, with the yeomanry and militia attached to them.

Such a system as this would thoroughly test the training of the whole, and enable the 5 *corps d'armée* when required, to assemble for active service without the least delay or confusion, whilst the Officers of the staff would know what was required to complete and render them fit to take the field. They would form an army, in short, as well organized as either of the Prussian armies which invaded Bohemia in 1866, provided the non-combatant branches corresponded to its wants.

The Militia artillery should remain as at present, as its services would be invaluable in manning the guns of our coast batteries and fortifications, in conjunction with the regular garrison and Volunteer artillery.

The next step is to give the field artillery such an organization as to render it capable of expansion. Such a force of infantry and cavalry as we have described requires a proper proportion of field artillery. We want for the five *corps d'armée* 120 guns of horse artillery, and 360 guns of field artillery. According to the present system, this would be 80 batteries of 6 guns each—a great many more than we now have. To be able to obtain this number of guns as quickly as possible, we should have more batteries, with fewer guns in each, as it is far easier to increase the number of guns in a battery than to create new batteries in a time of emergency; and instead of having 80 batteries of 6 guns in time of peace, it would be better to have 60 batteries of 4 guns to be increased to 8 guns in time of war. This organization would allow of our field artillery being doubled in the shortest possible time. I would apply this system to the whole of our field artillery, as it would also be necessary for India.

A brigade of artillery should supply the wants of a *corps d'armée*, and consist, in time of peace, of 3 troops of horse artillery, and 9 field batteries of 4 guns each. In time of war these batteries, increased to 8 guns, would give the number required for a *corps d'armée* at its war strength, viz., 24 guns horse artillery, and 72 guns field artillery. In time of peace, when these brigades joined their respective *corps d'armée* in camp, and the batteries were increased to 8 guns, they could make use of the horses from the second line of waggons for

the extra guns, and leave the waggons at the different stations they came from; or, if any difficulty was experienced in this, they need only be increased by 2 guns.

We have now come to the last step, which is to form *depôts* for establishing and training a reserve, so as to supply men for the different services. The third battalions of militia would furnish the men for our battalions of infantry; those for the other branches could be obtained in the following manner:—Attach to each of the 60 third or *depôt* battalions of militia, a *depôt* battery for the field artillery, a *depôt* company of engineers, and a *depôt* troop of military train. They must be composed of men who will serve with the corresponding regular branches of the Army in time of probable invasion, and during a portion of their annual training. Each *depôt* battery of artillery should consist of about 120 men (a proportion of whom should be drivers), and be trained by competent artillery instructors, and commanded by an Officer who has served in the regular Army. If the twelve years' service men from the artillery were enrolled in these batteries, there would be no lack of instructors. In the same way I would establish a *depôt* company of engineers. If each company consisted of from 30 to 40 men, it would be sufficient, they could also be instructed by the twelve years' service men, like the artillery; an Officer who had served in the regular engineers might be appointed to command, or as an inspector to a certain number of companies. *Depôt* troops of military train might also be established, consisting of men who, from their knowledge of horses, would make drivers, and the number of men in them might be unlimited. The five regular *corps d'armée* could thus be raised immediately to 80,000 men; and by means of the organization proposed for the militia and yeomanry, they could at once be doubled, and form a perfect and complete army of 160,000 men, around which all the armed force of the kingdom might rally to resist invasion.

Now, if such an organization as this existed, on the order being given for any *corps d'armée* to be put on the war footing, it could be done without delay or confusion, and be ready to take the field in the shortest possible time. Every Officer and soldier would serve in it with the greatest confidence. As it is at present, we cannot feel otherwise than that we have an Army which might fail in the hour of need through want of organization. Contrast one of these *corps d'armée* with a Prussian corps. Our British corps would consist, in round numbers, of 24,000 infantry, 3,600 cavalry, 96 guns, 600 engineers, 1,100 military train, whilst the Prussian consists of 25,600 infantry, 3,500 cavalry, 96 guns, 618 engineers, 3,700 train. They are almost identical, with the exception, however, of the military train, which is $3\frac{1}{2}$ times stronger in the Prussian corps. We know how admirably organized the Prussian *corps d'armée* were found to be, it is, therefore, no disparagement to ours that they should be like them.

This scheme would allow our army to be reduced to the lowest possible limits in time of peace, as it would only be necessary to have a sufficiency of trained men in reserve with the *depôt* battalions of militia to be able at once to fill up the different services to their

full strength to resist invasion. Our battalions might not be so perfect as they now are, but the whole Army would be much more efficient.

I remarked at the beginning of my lecture that this organization could be carried out without incurring extra annual cost. A primary expense would be caused, however, by having to construct barracks at the head-quarters of each of the sixty regiments of militia. There would also be a further expense entailed upon the country in acquiring the right to encamp troops on convenient heaths and commons, and for the purchase of sites for that object. As it is necessary to increase some of the branches of the service, such as the field artillery and military trains, to enable them readily to meet the requirements of the army in time of war, it could be done without expense by slightly reducing the strength of the battalions of infantry. It has been stated before, that infantry is inefficient without the other services, and when required can be more readily increased.

Any one who considers the present organization of our army cannot but feel surprise and astonishment that the country should for so long a time have submitted to an enormous extra expenditure in time of war for want of organization and a proper proportion between the services in time of peace. We know how the army suffered in the sieges during the Peninsular war for want of a sufficient engineer corps and siege train. If the infantry had been 3,000 or 4,000 less, and the engineers and artillery increased by that number of trained men, what a loss of life would have been saved! We need only go back to the army in the Crimea, with its inadequate force of engineers, and without any military train, to see how differently it would have been situated had only 1,500 of the infantry been trained sappers, and 2,000 employed as military train. It was well known before the Crimea that railroads would play an important part in future wars, and consequently the engineers of our Army should have been trained in their construction and use. The 1,500 additional sappers might have been used as infantry if required, but employed in their legitimate occupation, they would have saved the great expense of the army works corps, and have made a tramway or light railway from Balaclava almost to the front before the Army began to die from starvation and exposure. What would not a military train 2,000 strong have done towards saving our army from destruction? Under these circumstances I think we may come to the conclusion that it would have been better to have had 3,500 less infantry in the Crimea, and to have employed this body of men in the above-mentioned manner, as they would have saved the remainder from destruction. We are now very little better off than we were during the Crimean war; we have a larger force of field artillery, and a small body of military train, but if we were to put 30,000 men into the field to-morrow, we could not undertake any operations a few marches away from our ships.

In considering the subject of the volunteers, although at different times there has been a large force of them in England, we find the present movement is quite one of recent date. It is nothing more than

what should always exist, as every able-bodied man should be trained in the use of the national weapon, whether it be a sword, a bow and arrow, or, as in the present day, a rifle. In these times, however, it is also necessary that they should be able to act in bodies, and thus the battalion and company drill is required. The present volunteer movement is essentially battalion, and if they will train themselves in the use of the rifle and learn their battalion drill, that is all that we should expect from them. If we try to give them the organization of a regular Army, we shall be going too far, as they could not be really effective without all the other branches of the Service, such as field artillery, cavalry, and military train, besides the non-combatant branches. For 170,000 volunteers, the number of field guns required would be at least 500, and without any disparagement to the volunteers, I think it quite impossible that they could produce such a force of field artillery fit to take the field. If the movement continues with its battalion organization, it will be found of the greatest use to the country in case of emergency; but if we attempt to give it an Army organization, it would tend to give the country a feeling of false security.

It is thus that I would utilise our volunteers. When the *corps d'armée* were called out to oppose an invasion, I would attach to each brigade of infantry two battalions of volunteers. If the battalions were 600 strong, which is a fair average, it would absorb 24,000 at once; but if a little time were given, the infantry brigade might be divided and take 48,000 volunteers or more. Very large garrisons would be required for our dockyards, and here our volunteers would be of the greatest service; Portsmouth could employ at least 40,000 or 50,000, Chatham 30,000, Dover 20,000, Plymouth 40,000, Pembroke 30,000; in round numbers for these places alone, 170,000, and there is also the north of England, Scotland, and Ireland. The garrisoning of these important places would give work enough for our volunteers, and by liberating our Army of 160,000 or 200,000 men for service in the field, they would enable it to hold its own against any probable invading force. Behind the fortifications of our dockyards the volunteers would quickly be formed into most efficient and formidable armies, who could attack the rear or threaten the communications of an enemy.

If the militia in our North American colonies was organized on the plan proposed for that of the United Kingdom; by sending the 5 *corps d'armée* from this country to join it, we could at once place an organized Army of 160,000 men in the field for their defence; and any of the militia battalions, in addition to those required to join our regular Army, would be available to garrison the fortresses. Thus it will be seen, that by the withdrawal of a few of our regular battalions from these colonies in time of peace, we should be in a much better position to defend them when called upon to do so.

With regard to the dépôts for the instruction of recruits for our Army, I would remove the present dépôt battalions, and distribute them among the barracks for the militia. They would then become schools for the instruction of the recruits for all the different services

of our Army. They would be the centres at which every able-bodied man of the nation could be drilled, if necessary, and also become the head-quarters for the recruiting.

Before concluding this lecture there are some suggestions which I should wish to make.

During the Russian war, a great proportion of the men of the militia passed from its ranks into the regular Army, and several whole battalions volunteered their services for the Crimea. Will not any war in which we are engaged be popular with the people of this country? If it were not, could it be carried on? Cannot this enthusiasm be made use of? Why should not our militia, or rather let us call them "Army of Reserve," be in a great measure a volunteer Army, for general service during war only? Then the first battalions of militia could be composed of men whose services would be at the disposal of the country, for employment abroad during time of war. Would not a comparatively small inducement held out to them, secure their services, and also those of the men we require for the field artillery, engineers, and military train? It should be clearly understood that they would be only liable to serve during the continuance of hostilities, and so soon as peace were made, they would be allowed to return to civil life. Then we should be able to despatch from our shores an army of 160,000 men, which would only require an augmentation to the cavalry, to make it perfect.

As to the means of obtaining recruits to fill up the casualties of war. Why should we enlist men in time of war for 12 years' service? Why not enlist them for service during the war only? Many a man would become a soldier for the excitement of a campaign who is now deterred from enlisting because he must do so for 10 or 12 years. A considerable increase to the field allowance would offer a great inducement to men to enlist for a campaign.

It is possible that this country may some day be obliged to put 300,000 or 400,000 men into the field; how could it do so effectively unless we organize our present forces in such a way as to be capable of expansion? Whatever objections may be made to this scheme (and it is quite impossible to devise one against which many may not be raised), there remain these facts, *that with the forces now at our disposal, and without any increase in our present annual expenditure, we should be able to turn out for the defence of the country, in the shortest possible time, a thoroughly organized army of 160,000 or 200,000 men, and also have the means of despatching from our shores a perfect expeditionary corps of 80,000 men.*

Do we not require such an organization for our army? If so, let us not wait until we have been taught the necessity for it by a great national disaster.

Evening Meeting.

Monday, April 27th, 1868.

MAJOR-GENERAL THE HON. JAMES LINDSAY, Inspector-General
of Reserve Forces, in the Chair.

NAMES OF MEMBERS who joined the Institution between the 20th and 27th
April, 1868.

ANNUAL.

Mainwaring, Alfred R., Lieut. R.A. 17.
Moffatt, Boland G., Lt. 8th, or King's. 17.

ARMY ORGANIZATION.

OUR INFANTRY FORCES AND INFANTRY RESERVES.

By Major ARTHUR LEAHY, R.E.

THE CHAIRMAN.—Major Leahy, whom I have now the pleasure of introducing to you, will read us a paper this evening upon "Army Organization, our Infantry Forces and Infantry Reserves." It will be in the recollection of many of the gentlemen now present, that, a short time ago, Major Edwards read a paper in this theatre entitled "An Organization for the Army of England." The subject of Army Organization is now engaging great public attention. It is perfectly evident that within the last year, public opinion has been formed to this effect, that, with our considerable force of Militia and Volunteers, it is now high time that the various forces which compose our Army and its Reserves, should undergo such an organization, as will, in the event of a war, adapt them to the service of the country, not only at home but abroad. Without carrying the scheme so far as either Major Edwards or Major Leahy propose to do, for there is still considerable difficulty in this country in bringing our Reserve Forces, in the shape of the Militia and Volunteers, into a more active organization for the purpose of instruction, some assurance must be given to the country, that these forces are being organized, and brought together from time to time for the purpose of acting as an Army, instead of each force remaining in that isolated state in which hitherto it has been for years.

Therefore, whether the larger plan which these two gallant Officers bring forward can be carried out later or not, there is no doubt that there is a call for an organization of some kind or other, and unless this be brought forward in the course of another year, the public will be greatly disappointed. The subject has been noticed in the House of Commons; it has been engaging public attention; and sooner or later, through the agency and help of gallant Officers like Majors Edwards and Leahy, this desirable organization of the Army will doubtless be carried out.

Major LEAHY: I am induced to lay before the meeting the propositions in the paper which I am about to have the honour to read, in the hope that I shall thereby contribute to the ventilation of the important subject which was recently brought under the notice of the Institution by Major Edwards, in a lecture entitled, "An Organization for the Army of England," and I feel sure that any suggestions which may encourage discussion, or help towards bringing about a practical solution of the difficulties with which the subject of Army Organization is surrounded, will be indulgently received by the meeting.

I do not propose to enter into the circumstances, so fully set forth in Major Edwards' paper, under which an earnest consideration of the question is called for at the present time, but it appears to be necessary, for the proper understanding of what I am about to say, that I should recite certain general propositions which were enunciated at the lecture, and in which I venture to assume we shall all concur.

These propositions are—

1. That it is the general opinion of the public that there are defects in our military organization which require to be remedied in order to admit of the armed Forces, maintained by the country, being used to the best advantage.

2. That these changes are more especially necessary in respect of the Forces for national defence, and that if the necessary reforms be carried out, we ought to be in a position to place in the field, at very short notice, an army of about 200,000 men for home defence, and by so doing, to save the nation from periodical invasion panics.

3. That if circumstances should arise which render necessary the despatch from our shores of an expeditionary force, we should be in a position to equip and send out a limited expeditionary corps without delay, confusion, or extravagant expenditure.

4. That our self-governing colonies, more especially the dominion of Canada, are bound to train local militia, or other forces, to co-operate with our regular Army in the event of the occurrence of wars requiring that the several territories should be protected from aggression.

5. That it is desirable to effect any necessary changes without increased annual expenditure, without injuriously affecting existing interests, and on a system which will admit of a reduction of the standing Army to a minimum establishment in time of peace.

These, I apprehend, comprise the chief points of the problem which we would desire to solve, and I am impressed with the idea that if

the subject be dealt with on a comprehensive basis, and with a determination that in carrying out any necessary reforms, objections on matters of detail shall not be allowed to interfere with the execution of such general scheme as may be eventually approved, the solution will not prove so difficult as may be supposed.

On one point only do I desire to express a strong doubt, that is whether any scheme to carry out the project for keeping a larger number of men in immediate readiness for active service can be carried into effect without an immediate increase of annual expenditure. I do not think, however, that the public would object to that expenditure, provided it was solely incurred on the "non-commissioned officers and rank and file" of the additional forces, and not absorbed in additional staff or establishments.

The extra expenditure would be tolerated with less grudging if the project provided for an eventual reduction of the non-effective charges which now absorb over two millions of the fifteen and a half voted in the Army Estimates.

The subject of Army Organization has, it appears to me, to be considered under the following heads:—

A. Political. Under this head may be considered—

The constitution and government of the military forces and establishments. The persons liable to military service, and the conditions of such service. The general control or checks to which the executive, charged with the management or command of the Forces, and with the expenditure of public moneys set apart for military purposes, shall be liable.

B. The organization and training of the combatant forces, and the regulations under which they shall be called out. The determination of the numbers to be annually embodied, and whether for permanent service or for a certain number of drills or days' training.

C. The administrative organization, viz., that by which the supply of all things necessary for the efficiency of the combatant troops is regulated, and the accessory arrangements, made with the object of increasing their defensive or offensive powers.

Under each of these divisions several important questions may be raised on which lengthened discussions could be taken; but although necessary for purposes of explanation to refer to points which do not come under that head, it is not proposed to invite discussion on questions other than those necessary for the consideration of the second division, viz., the numbers, training, and organization of the combatant troops.

Even that appears to me too large a subject to be exhaustively dealt with in a single paper, and I only propose to enter into the details of that branch of it which relates to the organization of the infantry forces on the British establishment, and our home reserves.

On the numbers, organization, and distribution of the infantry must depend the proportion and organization of the auxiliary arms of

the Service, viz., cavalry, artillery, engineers, and of that portion of the train which has a place on the field of battle for the transport of ammunition, wounded, &c.

I will, in the first place, call your attention to the composition of the Imperial Forces and to the figures, which I believe to represent tolerably correctly, the numbers of the regular troops and of the reserve and auxiliary Forces which it is within the power of the Crown to call out for defence of this realm, or of the possessions subject to Her Majesty.

The establishments which at the present time come under the supervision of the Governments of this country and of the Governments of India, Canada, and the colonies in Australia, the Cape, &c., are—

I. *The Regular Army.*

The existence of this Army is dependent on the annual votes of Parliament, and the total numbers voted for the year 1868-9, including the proportion of British regiments set apart for service in India, and paid out of Indian revenues, are as follows:—

REGULAR ARMY, 1868-9.

			British Establishments.	Indian Establishments.	Total.
Infantry .. ..	..	..	87,898	45,962	133,860
Colonial Corps .. ..	..	..	7,770	..	7,770
			<hr/> 95,668		<hr/> 141,630
Artillery .. ..	..	..	20,712	12,855	33,567
Cavalry .. ..	..	..	12,189	5,410	17,599
Engineers .. ..	..	..	4,726	339	5,065
Train .. ..	..	..	1,798	..	1,798
			<hr/> 135,093	<hr/> 64,566	<hr/> 199,659
Miscellaneous Corps and Establishments .. ..	..	..	13,698	..	13,698
Totals .. ..	..	..	<hr/>148,791	<hr/> 64,566	<hr/> 213,357

The whole of the foregoing numbers are embodied for permanent service.

The number of horses on the British Establishment is 13,000.

In reference to the regular Forces, I do not propose any material alteration in the total numbers of the Officers, non-commissioned officers, and men of the infantry regiments (I have not gone into the details of the other branches of the Service). What I do propose is, that the infantry shall be so organised that the regiment shall be the unit for purposes of recruiting, for training soldiers for colonial or Indian service, and for training reserves. Each regiment should therefore consist of two or more battalions, one battalion being on colonial

service, and made up to its quota by periodical drafts of volunteers from the home battalion. To the home battalions should be attached a proportion of the army reserve forces sufficient to make up both battalions to the war establishment.

The details will be found in the tables, which have been printed as appendices to this paper.

I propose that the position of Officers commanding regiments and battalions shall be improved; the former so as to be equal to that of regimental Colonels of the Royal Artillery, and they shall be made responsible for the recruiting of their regiments, and be entrusted, subject to proper checks, with the management of the reserves which are held in readiness to fill up the ranks of their corps in the event of the occurrence of war or other contingency requiring it to be placed on a service footing.

Subject to approved regulations, they would determine the time, and place at which each reserve soldier should undergo his annual training, and probably regulate the retaining fee accordingly.

They would, in fact, be generally responsible, not only for the drill and discipline, but also for the establishment of the regiments.

The unit for purposes of administrative organization, would be a division (or, in time of peace, a military district), consisting of two or more brigades.

The duties of inspection and supervision of training to devolve on the General Officers commanding districts, and the Brigadiers serving under their orders.

The supervision of all enrolled Forces, whether reserves, militia, yeomanry, or volunteers, to be entrusted, ex-officio, to these officers.

In camps, when the militia and volunteers would be brigaded with the Line, the officers commanding regiments would become the acting brigadiers, assisted by temporary staff, selected probably from officers who had passed the Staff College. Their fitness for active commands would then be tested, and the command of a regiment would be sought as the last stepping-stone to a General's command.

II. *The Local Army in British India.*

The numbers and composition of these forces, which are paid out of Indian revenue, are decided by the Secretary of State for India in Council, subject to the sanction of Parliament.

According to the official book, entitled "Army of Great Britain, 1867-8," published by the Topographical and Statistical Department, the present numbers are as follows:—

Infantry	104,070
Artillery	2,097
Cavalry	23,585
Engineers	3,248
Miscellaneous	4,020

Total	137,020
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These forces are permanently embodied.

III. *The Reserve Forces.*

The establishment of these forces was fixed by the Army and Militia Reserve Acts of 1867, and they consist of three classes.

Class I. Men who have served or are serving with the regular forces, and whose first service has not exceeded the first term of enlistment 20,000
These men are to be liable to permanent service in or out of the United Kingdom.

Class II. Pensioner reserve.. .. 30,000
These men are liable to service in the United Kingdom only.

Class III. Militia reserve 30,000
To consist of volunteers from the Militia, and to be liable to general service.

Total	80,000
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These establishments have not yet been completed, nor does there appear to be any immediate prospect of filling up class I. The regulations in respect of class III. are not yet published.

The modifications that I would propose with the object of increasing the numbers and efficiency of the reserves are—

1. To attach to each regiment the proportion of reserves required to fill up its ranks in time of war. This will absorb classes I. and III. (say 50,000 men in all).

To entrust to the professional officers, now kept up for the purpose of commanding these men, the duty of training them, and not to depute that duty to militia officers.

2. To shorten, if necessary, the period at which a soldier may pass into the reserve, especially in those cases where the men have learned an industrial employment in which they would be likely to lose proficiency by a long period of embodied service. This ought to increase the number of enlistments and diminish desertion.

3. To form special corps for garrison duties, composed of men of good character who have served with their regiments for a *full period of home and colonial service*, and who have been allowed to re-engage for further duty.

These corps shall be formed on the model of the Coast Brigade Royal Artillery, and to be employed in the United Kingdom and in the Mediterranean, St. Helena, &c. The men to undertake certain garrison and other duties which now take men away from their regimental duties and interfere with the training of young soldiers; and to be employed, when possible, on the public works, or in other duty for which extra pay is granted. Clerks and messengers in military offices, servants for staff officers, &c., should, when not pensioners, be taken from the men of these corps.

They should have special privileges in respect of marriage, exemption from drill, &c.

A small proportion of officers only need be permanently employed, and the greater proportion of these might be taken from the ranks. In time of war the complement of officers could be completed from the half-pay list.

These corps would form the "cadre" to which the disembodied pensioner force of 30,000 men would be attached when permanently enrolled, or when mustered for inspection, and they would be very useful for the defence of fortresses; more especially when the war garrison would consist chiefly of volunteers.

The pensioners from the cavalry, artillery, and engineers should be attached to their respective corps.

It has been stated before the Royal Commission on Recruiting (Question 4,299) that the large proportion of re-enlistments in the Royal Artillery is in no small degree influenced by the inducement of service in the Coast Brigade; and it is conceived that the formation of a similar corps for line soldiers would have the effect of making the service more attractive.

IV. *The Auxiliary Forces*

Comprise the militia, yeomanry, volunteers, and trained bands.

(a.) *The Militia*.—The present establishment for the three kingdoms is 120,000, with power upon invasion, or imminent danger thereof, to raise it to 180,000 men, the original and additional numbers being as under:—

For England (by 15 and 16 Vic., c. 50)	.. .. .	{ 80,000
		{ 40,000
For Scotland (by 17 and 18 Vic., c. 106; 23 and 24 Vic., c. 94)		{ 10,000
		{ 5,000
For Ireland (by 17 and 18 Vic., c. 107; 23 and 24 Vic., c. 94)		{ 30,000
		{ 15,000

And, as to *England* at least, the total number may be raised by ballot.

In the estimates of 1868-69, provision is made for the embodied pay of 5066 permanent Staff, at a cost of £205,000, and for the pay during training, of a proportion of the 128,971 militia officers, non-commissioned officers, and men, the sum taken for training is £194,000, being somewhat less than the cost of the permanent Staff.

This is a fact which I would ask you to bear in mind. It is a question whether the numbers and cost of this staff may not be reduced.

The militia has existed as a county establishment for over three centuries, and service in the force is compulsory (with certain exemptions) for men between the ages of 18 and 30, to be selected by ballot from lists prepared by the Lord Lieutenant; any man drawn has, however, a right to provide a substitute, and as there is now no difficulty in obtaining the requisite number of volunteers for the authorized bounty of £6 (spread over five years), the ballot is annually suspended by Act of Parliament.

The number of militia called out for training in 1866 was about 71,000, of these about 4,400 were absent without leave.

Several letters have recently appeared in the papers urging the necessity for paying more attention to the training of the militia, and especially advocating greater care in the selection of officers, who, according to the intention of the force, ought to be county gentlemen, with local interests common with their corps.

It is represented that in consequence of the system of appointment and the absence of test of personal fitness for command, the officers are not up to the mark. If this be so, the defect should be remedied, but there would not appear to be any reason for disturbing the constitution of this, our earliest, military force.

(b). *Yeomanry Cavalry*.—This volunteer force takes precedence immediately after the militia, and before other volunteer corps.

In case of rebellion, or invasion, or on appearance of an enemy on the coast, this force may be assembled for active service.

The yeomanry consist of 48 corps, comprising 264 troops; the total number as shown in the estimates 1868-9 is 16,185. It is suggested whether "appearance of an enemy on the coast" is not in these days of steam an expression now out of date, and one which should be revised.

(c). *The Volunteers*.—No limit is placed on the Crown as to the number of volunteers which may be enrolled for service.

The volunteers can, in case of invasion, be ordered to march to any point within Great Britain.

The establishments and efficiencies of the volunteer corps which have been formed under authority are as follows:—

STRENGTH OF THE VOLUNTEER FORCE, 1867.

Arm.	Maximum Establishment.	Enrolled.	Efficient.	Extra Efficient.
Light Horse	935	699	507	458
Artillery	40,666	35,508	30,611	...
Engineer	6,580	5,511	4,715	4,301
Mounted Rifle	575	394	272	114
Rifle	167,056	145,752	119,111	85,715
Total	215,812	187,864	155,216	90,588

(d). *Trained Bands*.—It would appear that the 46 Geo. III., c. 90, though not in operation, is still in force, and could (it is presumed) be put in operation in England (excluding Wales) by Order in Council and proclamation. Under it the Crown can enrol 200,000 men, and upon invasion or imminent danger thereof can embody them for service.

It must be borne in mind that there has seldom been any difficulty in supplying the ranks of the defensive forces with recruits; for, should recruits fail to present themselves as volunteers, Parliament would be ready (judging from the experience of the past) to concede to the

Crown the power of raising them by conscription; but that with regard to the offensive forces the same observation does not apply; on the contrary, great difficulty has always been experienced in keeping their ranks filled with recruits to meet even the waste which war occasions, and far greater difficulty in increasing their numbers.

V. *Reserve Forces in British Possessions Abroad.*

Particulars of these forces are given in the book before referred to.

The approximate total numbers are 303,000 men and of these about 220,000 are infantry. The cavalry exceed 5,000.

These numbers are considerable, but they appear to be very insufficiently organized and trained.

The establishment of the active militia of Canada alone amounts to over 150,000 men, but it has had very little training.

May not this be accounted for by the unwillingness of the Colonial Legislatures to provide for the cost of the permanent staff, which in our own militia forms so large a proportion of the cost of training? In the colonies much higher pay would have to be given to secure the services of competent instructors, who would, as in England, have little or nothing to do for 11 months in the year.

For this reason I have, as one of the main proposals of my scheme for Army Organization, advocated the retention in certain colonies of a small number of battalions, containing a small number of men, but a full proportion of officers and non-commissioned officers.

The following is an extract from the proposal:—

“In certain of the British colonial possessions which are required to contribute to their own defence, local reserves should be organized and trained so as to form part of the Imperial Army.

“This may be done by reducing the number of private soldiers in the battalions and affiliating to each battalion a proportion of local reserves.

“This would not only lessen the drain on this country for men in time of war, but would effect a saving of expenditure in training local reserves.

“It would moreover be possible to train during the drill season two or more batches of reserves with each battalion, so that the number of men held in reserve might be much larger than that required to fill up the ranks of the battalions.

“Emigration to Imperial colonies might be encouraged by allowing the men to settle subject to service in the reserve, and the ‘outflow through emigration,’ which is now an ‘obstacle to recruiting,’ might be turned to account in reducing the drain on the mother country for soldiers to defend her own colonies.”

There appears to me to be no reason why the battalions in British North America should not be made up so as to provide nearly the whole of the training staff for the local militia.

Extra duty pay should, of course, be given to officers, non-com-

missioned officers, and men during the time they are employed as instructors of militia.

From the foregoing sketch of our Military Forces it will be seen what a very large body of men there is to be dealt with, and how much may be done by devising a comprehensive scheme of organization, and carrying it out, if necessary, gradually.

The organization of these forces would appear to be a duty that devolves on the executive Government of the day, subject of course to the approval of the Parliaments concerned, by whom any necessary funds would have to be provided. I apprehend that little if any legislation is necessary to give effect to an efficient organization.

To sum up the numbers are as follows:—

I. Trained and more or less organized,				
<i>a.</i> Regular forces (British and Indian) ..				213,357
<i>b.</i> Local Army in India				137,020
				<hr/>
Say ..				350,000
II. Trained but not organized,				
Home.		Establishment.		Trained.
<i>c.</i> Reserves ..	..	80,000		18,000
<i>d.</i> Militia ..	..	134,037		91,000
<i>e.</i> Yeomanry ..	..	16,185		16,000
<i>f.</i> Volunteers ..	..	215,812		155,000
Total, Home Reserves		<hr/>		<hr/>
enrolled ..	..	446,034		280,000
<i>g.</i> Colonial Reserves (probable)				
number ..	..	..		100,000
				<hr/>
Total, trained but not organized (say)				380,000
III. Neither trained or organized,				
<i>h.</i> Incomplete Establishments,				
Home Reserves ..	..	..		167,000
<i>i.</i> Trained Bands ..	..	..		200,000
<i>k.</i> Colonial Reserves (balance of				
303,000) ..	..	..		203,000
				<hr/>
				570,000
				<hr/>
Grand Total of Imperial Forces (say)				1,300,000

Before entering into further explanation of the changes which I advocate, I desire to bring to your notice certain additional information and facts which it appears to me should be prominently before you during a discussion.

You are all doubtless aware that for many years prior to 1847, the

recruits for the regular Army were enlisted for life, although usually discharged to pension of 1s. per day at the end of 21 to 24 years' service.

The Army Service Act, 1847, limited the first period of engagement to 10 years, for the Infantry, and to 12 years for the Cavalry, Artillery, and Engineers. If engaged for additional periods to complete 21 years' service, in the Infantry, Artillery, or Engineers, or 24 years in the Cavalry, pensions of 8d. per day with an addition for good conduct were given on discharge.

The objects in view in making limited enlistment compulsory, appear to have been as follows:—

(1.) To induce a larger proportion of young men to enter the army, and by ameliorating and shortening the conditions of service, to cause it to be deemed a punishment to be turned out of it.

(2.) To throw back on the country a larger proportion of men who had a regular military training, and who would in time of need be available for national defence. These men to be encouraged to join a reserve force.

(3.) By discharging the men before they had completed the service necessary to entitle them to a pension, and during a period of life at which they could revert to industrial employments, the estimates would have been eventually relieved of a proportion of the non-effective charges.

From the years 1848 to 1854, while the Army was maintained on the peace establishment which for so long a period had been its normal condition, the provisions of the Army Service Act, 1847, were found to answer necessary requirements; but when in 1855 there was, consequent on the Crimean War, an extraordinary demand for recruits, it was found necessary to shorten the period of enlistment, and temporary powers were obtained to legalize enlistment for a shorter period, to be regulated by Order in Council. Under these powers, which have now lapsed, men were enlisted for the duration of the war.

During the years 1864-5 there was difficulty in obtaining a number of recruits sufficient to meet the losses resulting from deaths, discharges, and other ordinary causes, and the deficiency was likely to be still further increased on the expiration of the term of service of the men who had enlisted for 10 years during the Indian Mutiny of 1857-8.

In April 1866, a Royal Commission was appointed to enquire into the causes of the deficient supply of recruits; to suggest remedies for the removal of this deficiency; to report on the operation of the Army Service Act, 1847; on the expediency of retaining powers over men after their discharge; the periods for which men should be engaged; the foundation of a reserve force; and the adoption of a system of recruiting for general service.

The Report of the Commission was made public in October, 1866, and the blue book which contains the evidence gives elaborate statistics shewing the working of the Army Service Act, 1847, together with outlines of the laws which then were, or had previously been in force for regulating Military Service.

As this Report sets forth the facts and statistics on which subsequent legislation has been based, and is the official document to which reference may most appropriately be made for purposes of discussion, the following extracts, which bear on the subjects proposed for consideration have been selected for insertion in this paper :—

In reference to the deficient supply of recruits during the years 1864-65, and the causes of such deficiency, the Commission reported that “the evidence which has been given before us and the returns “in the Appendix to our Report all tend to show that during the “last two years the number of recruits raised for the Army has not “been sufficient to supply the demand. The deficiency, however, is “not such as to create uneasiness, as we think that it may be traced “to causes which, for the most part, admit of remedies being applied “to them.

“For many years there existed in this country two distinct kinds of “military organization. The one was the regular Army, in which “the service was voluntary, and which was under the more immediate control of the Crown; the other the Militia, in which the service was compulsory.

“For some time past the principle of compulsory service has been “suspended, and by this departure from the old system, and by “adopting the same mode of filling the ranks of the Militia as is “resorted to for the Army, the recruiting for the latter in time of “peace has been, to some extent, interfered with; and to this may “be traced one of the causes of the present deficiency of recruits for “the line.”

After enumerating certain improvements effected in the condition of the soldier, the Report states that, “notwithstanding these great “improvements, it is to be feared that there is no increased disposition on the part of the youth of the country to look to the Army “as a profession.

“The constant outflow through emigration, the great demand for “labour in all branches of industrial employment, and the consequent “rise in the rate of wages, form, no doubt, a principal obstacle to “recruiting at the present time; but we are informed that the mode “of conducting the recruiting service itself is also far from satisfactory.”

With regard to the remedies required to remove the deficiency, the Report states :—

“We have examined various witnesses as to the benefits which “might result from localising different regiments, or connecting them “with special counties or districts; but we cannot say that this would “be a desirable or expedient course.

“On the other hand, strong evidence has been laid before us showing the advantages resulting to recruiting from a local connection “being maintained between individual corps and certain localities. “Men enlist much more freely in corps which already contain a number “of their friends and acquaintance; and such connections should,

“therefore, we consider, be in every way encouraged. Much may be done in this direction by strengthening the relations that exist between particular corps of the Army and particular Militia regiments, whether arising from county denomination or other circumstances, and the object might also be facilitated by the line regiments supplying good non-commissioned officers to the corresponding Militia regiments, and by directing the volunteering from each Militia regiment to one, or even two or three, regiments of the line.”

Then follow proposals for facilitating the transfer of recruits from the Militia to the line; for the grant of additional pay, good conduct pay, clothing, and rations, and the retention of pensions for long and faithful service, as means for increasing the popularity and efficiency of the Service.

In reference to the operation of the Army Service Act of 1847, the Report states “that limited enlistment is by no means a new feature in the Army, and that the period of service was at one time as brief as three years; that the framers of the Army Service Act, 1847, have been disappointed in the expectation that every person who declined to engage for the second period of service would enter into an arrangement whereby he might be enrolled in a reserve force, in which, under certain regulations, he might acquire a right to pension; and thus an army of reserve would be formed on which the country might rely in times of exigency; and that the reserve force, as constituted by warrant in 1859, has been a complete failure.

“There appears, on the part of the military witnesses, a strong opinion against the present law; but when they are asked whether it would be expedient to recur to the practice of enlisting nominally for life, but practically for 21 years, nearly all of them admit that such a recurrence is out of the question.

“Some of the witnesses recommend a lengthened period for a first engagement, even up to 18 years, but most of them concur in fixing the first period at 12 years, and in making it the same in all branches of the Service, with a second period of nine years, for which every soldier should serve to entitle him to a pension for life.

“Looking to the weight of evidence given on this subject, we recommend that a change be made in the present law, and that the periods of service be altered to 12 years for the first period, and 9 years for the second period, for all branches of the Service, making in the aggregate a service of 21 years, which every man should complete to be entitled to a full pension for life.

“Soldiers are by regulation permitted to purchase their discharges, and this permission is considered a boon, and is frequently asked for. We do not recommend its withdrawal; but, considering the high rate of wages to be obtained in civil life, as compared with those which prevailed at the period when the present price of discharges was fixed, we are of opinion that the scale should be considerably raised.

“A return in the appendix shows that during the five years ending

" 1864-65, out of 25,403 soldiers whose time of service had expired, 11,343 left the Army, whilst 14,060 remained.

" A comparatively small proportion of non-commissioned officers actually left the Army during a period of eight years, averaging during each year, for all branches of the service, only about 1½ per cent. of the sergeants, and about double that percentage of the corporals."

The Commission stated that,—

" In regard to the retention in the Army of men after the expiration of their first period of service, there can be no doubt that if we look only to the efficiency of the Army, and take into consideration the strong opinions which pervade the minds of its officers, it is not desirable that too many of the old and seasoned soldiers should be lost. Nor do we think that such is the case.

" The following table shows the comparative ages of cavalry and infantry, in proportion per thousand of strength; the age and service of the soldiers composing the cavalry and infantry are not less favourable for military efficiency at the present day than they were in 1846, just prior to the introduction of the Limited Service Act, when enlistment for life was the rule:—

Ages.	Cavalry.		Infantry.	
	1846.	1866.	1846.	1866.
Under 18 years	3·2	14·2	52·3	17·8
18 to 20 "	74·0	79·9	124·3	114·6
20 to 25 "	339·0	304·0	342·6	275·2
25 to 30 "	322·5	369·0	277·0	356·2
30 to 35 "	137·0	148·0	98·0	150·8
35 to 40 "	78·9	57·2	84·3	74·4
40 to 50 "	43·4	27·4	21·3	10·8
Upwards of 50	2·0	0·3	0·2	0·2

This table shows that out of 1,000 infantry soldiers, 407·6 were under 25 years of age; and only 85 exceeded 35 years.

" In the artillery nearly two-thirds of the men entitled to take their discharge re-engage, and in the Engineers about three-fifths.

" In the cavalry and infantry the proportion of re-engagements is considerably smaller."

Then follow sundry recommendations, having for their object an augmentation of the number of re-engagements:—

It was also recommended " that, on the score of health alone, men should not be sent out to India under 20 years of age. We further advise, on the ground of efficiency, that none but thoroughly trained soldiers should be sent abroad."

Further, "that in any modification of the Army Service Act, a dis-

“cretionary power should be given to the Secretary of State for War
“to authorize the re-engagement of men under orders for foreign
“service for such periods, not exceeding 12 years, as may extend
“their engagement to the full period during which their regiment is
“expected to remain abroad, accompanying their re-engagement with
“a graduated scale of bounty, according to the additional periods
“engaged for. Any men who, on their return home with their regi-
“ment, still require some additional service to entitle them to a pension
“for life, should be allowed to enter into a third engagement, but
“without bounty, in order to enable them to complete the full period
“of 21 years.

“That inducements be given to soldiers now serving in India to re-
“engage in that country after their first period of service is expired.

“The prevalent idea of the great dislike to service in India appears
“to be unfounded.

“Out of 18,804 soldiers whose first period of service expired during
“the six years ending in 1865, about one-half, viz., 9,431, re-engaged,
“leaving 9,397 to be embarked for England; and we think that
“with other moderate inducements, such as a small increase to the
“present scale of bounty, a much more favourable proportion might be
“obtained.

“Before closing our remarks on this portion of the subject, we
“would observe that the prolonged concentration of the military
“forces at home in large camps is a source of dissatisfaction. No
“doubt the greatest benefit is derived from bringing considerable bodies
“of troops of all arms together for exercise in summer; but we think
“that when the drill season is over the troops should be dispersed
“throughout the country, that they may be seen by and mix with the
“masses of their countrymen, and thus stimulate their military feeling
“and act as recruiting centres during the winter, which is the period
“most favourable for obtaining recruits.”

With regard to the system of recruiting, the Commissioners
recommended the establishment of “a distinct staff for recruiting
“purposes, which should be under the immediate orders of the Com-
“mander-in-Chief, and its head responsible to him through the
“Adjutant-General. This staff should consist of an Inspector-General,
“not attached to any particular district, but having under him as
“many district officers for assistant inspectors as may be found neces-
“sary fully to occupy the whole country, with subordinate officers
“again under them.

“The organisation should be completed by a certain number of non-
“commissioned Officers from each corps of the Army, supernumeraries
“to the establishment, who, while retained on the recruiting service,
“should be entirely at the disposal and under the control of the re-
“cruiting officers.”

They observe that bounty-money is usually spent in riot and dissi-
pation, and tends to encourage desertion, and do not recommend an
increase. An increase of bringing-money is, however, suggested.

They state that “we would by every means encourage enlistment
“at head-quarters of regiments, and it seems to us that if soldiers

“going on furlough were empowered to beat up among their friends for recruits, for whom they would receive the regulated bringing-money, some desirable additions might be made to the ranks of their respective regiments.

“In reconstructing the system of recruiting, great attention should be paid to the medical examination of recruits.

“It would be a great advantage if this could be done entirely by medical officers, subject to military authority.”

But no arrangement by which this system of enlistment could be made general was proposed.

The establishment of training schools as a means of providing recruits is suggested, on the ground that those for the Navy have been most successful.

In reference to the employment of soldiers, the Commissioners observe:—“It appears to us that in the infantry especially the soldier has a large amount of spare time on his hands, which might be turned to more profitable use than is now the case. To this end we would suggest that the soldiers should be taught industrial trades, and be encouraged to work at them when their doing so would not interfere with their military duties. They should all receive instruction in the use of the spade and mattock, so as to be able to wield them effectively, and to throw up earthworks with facility—a knowledge from which the greatest advantages might be derived on active service.”

The Commissioners conclude their report by reference to the formation of a reserve force, and state “that it opens up a very large question, the decision of which rests rather with statesmen and Cabinets than with a Commission such as that of which we are members.

“Recent events, however, have taught us that we must not rely in future on having time for preparation. Wars will be sudden in their commencement and short in their duration, and woe to that country which is unprepared to defend itself against any contingency that may arise, or combination that may be formed against it.

“The first duty of those who preside over the administration of the Army is to look to its constitution.

“As a peace establishment, and having in view nothing more than the proper provision of that military protection which we are bound to afford to our Indian territories and our extended colonial possessions, the Army is at present barely sufficient for these purposes; one, and not the least cause of its unpopularity as a service, arising from the fact that the soldier must spend two-thirds of his time in a state of expatriation.

“Under these circumstances we must look more to our Army. We think its present strength is barely sufficient for a period of peace, and the question is, how we can most readily and speedily increase it through the means of a reserve force consisting of men who have already received that training in its ranks, but may have fallen back into the ordinary duties and callings of civil life. We have already stated the fact that the ‘Army of Reserve Force,’ as constituted under the Warrant of 1859, has been a complete

"failure, and the measures which we have proposed to induce more men to re-engage in the regular Army, will no doubt tend still further to check its increase. Under these circumstances we are not prepared to propose any plan as one that may be relied on to secure a large army of reserve.

"Having thus given our opinion on the different points referred to us, in conclusion, we must observe that we are perfectly aware that our suggestions, if acted upon, will tend to increase the cost of the Army. But, when we consider the vast interests at stake, and the immense amount of wealth and property accumulated throughout the country as well as in our large cities, we cannot believe that the nation will hesitate in paying what, after all, will amount to a very trifling rate of insurance; and by maintaining the peace establishment of the Army in a sound and satisfactory condition, and having in its support a well disciplined reserve, we may thus arrive at a military organization such as shall give confidence to the country, and enable all your Majesty's subjects to prosecute without distraction those duties and pursuits in which they may be engaged."

It is impossible to read that Report without feeling that there *may* be solutions to the problems involved different from those proposed by the Commission, and as the *policy* of the results which the Act of 1847 was intended to bring about has not been questioned, it is submitted that proposals having for their object the attainment of those results are deserving of serious consideration.

In referring to the failure of the Act to produce the expected reserve force, may not this be accounted for by the fact that of the ten years' men more than half re-engage, and that of the non-commissioned Officers only $4\frac{1}{2}$ per cent. leave the Army in each year.

It is therefore for consideration, whether in place of inducing the men to re-engage and hold on for pensions at an annual cost per man which, including the value of pensions, is about double that of young soldiers, and about ten times that of a reserve soldier, it would not have been worth while to have tried the opposite course, of largely reducing the period of compulsory service, and of requiring all to leave the Army, except men of superior character and soldier-like qualifications, and those who have a claim to permanent employment in respect of colonial or active service, offering them the alternative of remaining on the rolls of their regiments for service in the reserve, with a liberal retaining fee.

It appears inconsistent to urge the importance of a reserve force consisting of men who have already received training in the ranks of the Army, and to propose measures that would have the effect of checking the increase of such reserve.

It may be interesting to examine the financial effect of re-engaging men for a second period of service (*viz.*, 12 to 21 years), as compared with a system of enlistment for short (say 3 years) service.

There is no official published statement of the present pay and allowance of a soldier of under 3 years as compared with one of over 12 years' service, but excluding bounty, barracks, medical attendance,

and some other items which I cannot exactly calculate, and which are common to all engagements, it will, I think, be found that the proportion is as follows, supposing the men to be well conducted :—

Under 3 years	£32 per annum.
12 to 21 years (average)	£40 „

So that if, in place of re-engaging the time-expired man, he were replaced by a young soldier, there would be a surplus of £8 per man per annum, to defray the cost of keeping the older soldier in a Reserve Force, should he be inclined to enrol himself.

The foregoing refers to the cost of the men while serving. But we have also to take into consideration the expectation of pension, the dead weight which the Legislation of 1847 was intended to lighten.

Referring to the tables attached to the Report of the Recruiting Commission, we shall find that more than one-half the recruits are enlisted under 20 years of age. The average age of soldiers who have completed 12 years' service may therefore be taken at 32, and they would be entitled to discharge with pension at 41. The average amount of pension for men who serve the full time is, I believe, about 1s. 1d. per day, or say £20 per annum.

If we turn to the annuity tables, to be found in the Postal Guide, page 44, we shall see that the lump sum to be paid at 32 years of age for a pension of £1 per annum, to commence at the expiration of 10 years from the date of purchase, would be £10 4s. 4d., or for a pension of £20 per annum, £204 6s. 8d., or, if paid by annual instalments, the annual payment would be £23 2s. 4d.; so that if the Army Estimates were to be relieved of the pension list, and the cost of paying and auditing the pension accounts—a measure which I believe would find favour with some of those best able to form an opinion on the subject—the War Department should pay to the Post Office Department a sum of about £23 per annum for every soldier of 32 years of age, re-enlisted under the Army Service Act, 1867. I believe that about 30,000 have re-engaged under the inducements offered on the recommendations of the Recruiting Commission. If the post office tables are applicable, the annual cost to the country of these men is not far from £600,000 per annum in excess of that which will appear in the estimates while they are serving.

A fact of interest in connection with the pension list is, that although there are 61,748 men in receipt of pensions, the numbers enrolled for service in case of emergency is only 14,100.

I will now examine the financial effect of holding out an expectation of a pension as an inducement to men to “enlist for a short term of “enrolled service, with a liability to afterwards serve in a reserve force,” as advocated by Lord Grey, in his letter of 23rd August, 1866, Appendix Y, of the Report of the Recruiting Commission.

It may be assumed that it would not be necessary to grant pensions until the end of thirty years' total service or 50 years of age, being ten years less than the age fixed for civil service pensions.

Supposing, as before, the average age of engagement to be twenty years, the lump sum to be paid down for a pension of £20 per annum, to commence at 50 years of age would be about £70, or about one-third the value of the pension of the re-engaged soldier of 32 years of age. The annual cost, if paid by instalments, would be about £4, as compared with £23.

If, therefore, the tables of the Post-office may be accepted as approximately applicable, there can be no doubt of the financial result of the short-service scheme, so far as pensions are concerned.

It is calculated that if in place of re-engaging 30,000 time-expired men we were to give them immediate pensions of from 4*d.* to 6*d.* per day as retaining fees for service in the reserve, with a promise that they would have pensions of £20 a year each on attaining 30 years' total service, and if we were to replace them by 30,000 younger soldiers, the cost to the country would not be so great as that of keeping the veteran soldiers in our regular Army, and we should within the next two years have a very respectable reserve composed of men who had received their training in the ranks of our Army.

The calculation on which this statement is based is as follows:—

	£	£
1. Annual cost of 30,000 re-engaged men (12 to 21 years' service) at £40 per annum		1,200,000
2. Annual cost of 30,000 young soldiers at £32	960,000	
Retaining fee of 30,000 reserve soldiers at £8.....	240,000	
Total annual cost of 60,000 men .		1,200,000
3. Present value of pensions of £20 per annum payable to 30,000 men of 32 years of age at 10 years from re- engagement.....		6,130,000
4. Present value of 30,000 pensions of time expired men payable after 20 years' service in reserves	3,200,000	
Present value of 30,000 pensions of young soldiers payable 30 years hence	2,097,000	
Total value of pensions ..		5,297,000

The annual expenditure for 30,000 young and 30,000 reserve soldiers being the same as for 30,000 re-engaged soldiers, the estimated saving in respect of the capitalized value of pensions is about £800,000.

It is an experiment, of which we have no previous experience, to enlist men on a *present* bounty for *future* active service before an enemy abroad; in effect, to give the reserve men all their advantages in time of peace, and to wait until time of war for their service. Hitherto a present payment has been the inducement for men to leave their homes and engage in active service before the enemy, and whether men who

have long before spent their bounty, and, therefore, have nothing to look forward to but the hardships and hazards of actual warfare, will be ready and willing to enter upon active service, must be, to say the least of it, extremely doubtful.

Enlistments for ordinary Army service are, moreover, made of men who are single, unmarried, and physically capable of serving. These facts being ascertained, the man at once enters upon service, and is constantly under military and medical "surveillance," so that though marriage or malingering or self-mutilation are not impossible, yet Her Majesty's Regulations forbid the one, and the other is a crime punishable under the 81st Article of War.

But with the new reserve force the case will be widely different. For eleven months in each year they will be civilians, and therefore can marry at any time without the breach of any regulation; and their physical capabilities may be altered by accident or design without incurring any punishment. Either or both of these incidents would gain them a release from their enlistment, or compel the Crown to take men into the service who would not otherwise have been accepted.

It is, therefore, very desirable that men enlisted for service on a contingency should have a prospective pecuniary inducement to appear when required.

Subsequent to the appointment of the Recruiting Commission, and while they were receiving evidence, war was declared between Austria and Prussia, and the astonishing result of the three weeks' campaign which ended in the defeat of the Austrians at Sadowa, and brought the war to a conclusion in a few weeks, caused increased public attention to be directed to our Military institutions, and people began to ask in what condition we should be were a hostile force to succeed in effecting a landing on our shores.

In the absence of any proposal from the Commission to provide for such contingency, the Prussian Military System under which such successful results had been obtained in Germany, was naturally suggested as a model whence an improved organization might be devised.

As the adoption of one or more of the principles of the Prussian system has been advocated by nearly all who have written on the subject of army organization, I have procured information from Lieut.-Colonel Cooke, R.E., of the Topographical Department, explanatory of that system. The Prussian system embodies three principles; the first, a general conscription with liability of every able bodied man to serve in the regular army or in its reserves between the ages of 20 and 27, and subsequently in the "Landwehr" between the ages of 27 and 32. All not serving in the army or Landwehr being liable to serve in the "Landsturm" between the ages of 18 and 42 inclusive.

This principle could not be applied to this country, mainly for the reason that our regular army is not solely defensive, two-thirds of the number being constantly on Colonial or Indian service.

The second principle, namely that of assigning to each regiment a particular territory, in which it is usually quartered, and attaching to

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The second principle, namely that of assigning to each regiment a particular territory, in which it is usually quartered, and attaching to

it a reserve and "Landwehr" battalion in which all eligible persons residing within that district must, for some time of their lives, be enrolled, has also been deemed inapplicable in this country, but it is submitted that a modification of the plan could with advantage be adopted by, as already suggested, attaching to each of our regular regiments a battalion for service in India or the colonies and a proportion of the Army reserves. Our militia, volunteers, and trained bands would correspond with the Prussian Landwehr and Landsturm.

The third principle of the Prussian system is to lighten so far as consistent with reasonable efficiency the military service, so as not to interfere with the industrial occupations or education of the young men who come up for service in the standing Army. And to specially shorten the service of those who are willing to relieve the state of the cost of their maintenance and equipment.

This is a principle which, it is submitted, admits of extensive application in our Army, and in its reserves.

Looking on military defensive service of the State as a tax to which all men are liable to contribute either time or money, there would not appear to be any reason why some privileges, or some exemptions in respect of taxation should not attach to those who give up, without adequate payment, their time to qualifying themselves for taking an active part in the defence of the nation.

In round numbers the annual pay and allowances of a regular private soldier are about £32, of a militiaman £6, and of a volunteer, £1 10s. If any members of the two latter classes will give up their time and spend money in order to attain a degree of efficiency nearly equal to that of the regular soldiers, they should be entitled to every consideration.

Lieutenant-Colonel Cooke has also lent me an abstract prepared by him of the militia laws in force in the State of New York, which is very interesting, as showing how the Prussian system has been adapted to meet the case of a Republican constitution.

The distinctive features of the New York system are—(1). That all able bodied men are liable to serve, but that most service is commutable by fines; the greater part of the funds to defray the expenses of the militia are raised by fines levied by non-attendance at drills, &c. (2). That subject to an examination as to fitness, and an inquiry as to character by the Commander-in-chief, the officers are elected, the company officers by their companies, the field officers by the company officers, and the brigadiers by the field officers.

During the months which elapsed between the publication of the Report of the Recruiting Commission, October, 1866, and the assembly of Parliament, February, 1867, articles appeared in more than one newspaper, notably in the "Pall Mall Gazette," and "Saturday Review," advocating the principle of enlistment for short periods of enrolled service, with liability to be called out on emergency during a longer term, and proposing separate engagements for Colonial service.

Concurring as I did in these views, I gave some consideration to the details necessary to give effect to these principles, and I came to the

conclusion that by adopting a regimental organization such as I have indicated, particulars of which are given in the printed tables, the system might be applied to our Army with but little disturbance of existing arrangements, without injuriously affecting existing interests, and without any expense beyond that which would be due to an addition, if any were needed, of the number of men enrolled for service. The scheme was brought to the notice of the Secretary of State for War, in January, 1867; it was subsequently printed in April, 1867, and submitted for consideration, in contradistinction to plans by which the Reserves, to fill up the ranks of the regular regiments, were proposed to be trained by and attached to the Militia.

I will now proceed to explain the main features of the organization which I advocate, and to state the points which are submitted for consideration.

The heads under which it appears to me the subject should be considered have already been stated (page 312).

Under the first head (A), that which involves political consideration, it is not proposed to alter any existing legislation at present, but if difficulty be experienced in making up the Reserves to the numbers authorized by Parliament, it is recommended that no opportunity should be lost of passing into them any of the recently re-engaged soldiers who may be willing to leave their regiments with the liability to come up when required; their places in the regiments to be taken by young soldiers.

The calculations showing that this would financially be the better course, have been already submitted, and if the military advocates for re-engagement were asked whether they would recommend the expenditure of a given sum of money in the re-engagement of 30,000 men, of 30 to 35 years of age, or whether, the funds being limited, they would prefer that these 30,000 men should be passed into a Reserve force, with power to call them up to rejoin their regiments, their places in the ranks being taken by 30,000 younger soldiers, of 18 to 25 years of age, I have little doubt but that they would prefer the larger number of men.

I apprehend that it is in the power of the Secretary of State to make regulations for giving effect to this suggestion.

If after some experience of the working of the system it should be found desirable to shorten the period for compulsory service, from two-thirds to, say, one-third, the period of the first enlistment, the alteration of a word in Clause 55 of the Mutiny Act, would give power to the Secretary of State to use discretion in the matter.

Under the second head (B) it was proposed (page 312) to consider the *numbers, training, and organization* of the combatant troops.

1. As to numbers, I have already stated (page 319) the authorized establishments, and it is not proposed to increase the establishments of the British Infantry forces, or of the Home Reserves (see Table III).

The only proposal submitted, with the object of increasing the num-

ber of men is one that was suggested to me, viz., that we should turn to account for purposes of national defence the large number of persons holding civil employment under the Crown.

On reference to the Navy and Civil Service estimates, it will be found that there are over 27,000 subordinate civilians employed by the Admiralty, Customs, and Excise Departments; over 15,000 are employed in the dockyards alone; these men might be trained by the staff of the proposed garrison battalions, with which they could, in the event of war, be associated for the defence of the fortifications that guard the establishment in which they earn their livelihood. The superior officers of the departments should be required to officer these men.

Having settled the number of men, the next step is to form them into "Companies," "Battalions," "Regiments," and "Brigades" for purposes of training and inspection, and to admit of their being readily formed into *Divisions* or *Army Corps*.

The present and proposed regimental establishments will be found in Table I, the main features of the regimental organization which is submitted for consideration are:—

1. That keeping up as we do infantry officers and non-commissioned officers in numbers sufficient to train and command 53,000 men in excess of our peace establishments, those officers and non-commissioned officers should be employed to supervise, train and command the 50,000 reserve men which Parliament has authorized the Secretary of State for War to raise and organize as a reserve for general service (See pages 313, 314, 315).

2. For the training and organization of the pensioner reserves, the formation of garrison regiments is proposed (see page 315), the composition and distribution of these corps will be found in the tables.

3. That the project may be carried out gradually and without a reduction of the old established regiments. The percentage of Officers and the number of men per company will be the same as at present and, taking into account the regimental reserves, the proportion of combatant officers to men will be sufficient, being in excess of that in the armies of the great Continental powers, viz.:—

British army	1 officer to 28 men.	Austrian army	1 officer to 40 men.
French	" 1 " 33 "	Prussian	" 1 " 49 "

The service battalions are proposed to be of nearly the same total strength as the infantry battalions now serving in India, and the brigades of about the same strength as at present.

4. By organizing the infantry regiments in two battalions and increasing the number of battalions on home service, it will be possible not only to organize our army reserves without additional staff or establishment, but to so arrange the military districts that each shall form the nucleus of an army corps with staff complete.

Some important improvements, many of which are suggested in the

report of the Commission on Recruiting could also be carried out, viz. :—

To facilitate the assembly of troops in camps during summer, and their dispersion in country quarters during winter.

To establish more permanent head-quarters for the several regiments, and thereby add to the comfort of the officers and men—establish local connections for recruiting,—admit of greater facilities for the useful employment of the men, and for their instruction in trades.

To define the period of service in India and the several colonies, and adapt it to the climate and conditions of each station. Many of the objections which soldiers now have to colonial service would be removed.

To conduct recruiting regimentally and without an expensive recruiting staff—the men in reserve, acting as recruiting agents to their regiments, and keeping up local connections.

By requiring reserves to be exercised at the head-quarters of regular regiments, the period of year at which the annual exercise should take place could be arranged so as to interfere as little as possible with the industrial occupations of the men. In certain cases arrangements might, with the sanction of the Commander-in-Chief, be made for exercising men in reserve with volunteer corps or militia regiments.

It is believed that the arrangements proposed would not only attract to the ranks of the Army a large number of intelligent men who would not now think of enlisting, but it would have the effect of making service in the army reserve force more popular than service in the militia.

In order to carry out the revised regimental organization, it would be desirable to select officers for the command of regiments and battalions, and that the appointments should be made without purchase, probably from a general list of field officers.

The pay of the Officers in command of regiments to be made equal to that of a regimental Colonel in command of a brigade of artillery, and that of an Officer in command of a battalion equal to that of a colonel 2nd Commandant of Marines.

This would involve, an increased annual expense of about £26,000 to be met by a reduction of the separate recruiting staff, which now costs over £27,000.

These appointments would give a professional opening to regimental officers, other than that of staff employ. The lowest staff position which a Captain can hold, is now better paid than the command of an infantry regiment, and it is not surprising that some of our best regimental Officers, especially those who, while desirous of making the Army their profession, cannot afford to serve for a pay little, if any in excess of the interest on the purchase money of their commissions, should take the first opportunity of giving up their regiments for staff appointments of comparatively minor importance.

I do not think that so long as the establishment of Officers is, as at present, in excess of the number actually required to train and com-

mand the men actually embodied, and while there is a demand for commissions in excess of the supply, any great increase of the standing pay of the regimental Officers could be proposed, but the position of regimental officers might be improved without any great expense, by giving the rank of major to captains of a certain standing, as it now is to Lieutenants in the Navy, and also as a reward for service in the field or other *good* service.

We should under the proposed regimental organization no longer have the frequent changes of establishment which have given rise to grievances on the part of officers.

A serious drawback to military life as a profession is the impossibility (without a sacrifice of promotion which is fatal to future advancement) of exchanging, when for sufficient reasons individual officers are unable to accompany their regiments on ordinary colonial service. By arranging the roster for colonial service regimentally, it would in such cases be possible, without injury to any one, to allow exchanges of home and colonial duty, and an officer who did not object to an extra turn of colonial service, could, as a private arrangement, receive a bonus for taking the duty of another. It would of course be necessary to keep a strict roster, and to specify the number of years for which the officers should serve with the battalion in the colonies. It would also be necessary to remove staff officers from the regiment, or to make them supernumerary, so that their special employment would not throw an undue share of duty on others. A reduction of regimental officers has been proposed to enable this to be done, and if further reduction were requisite, it would be carried out by not filling up all the vacancies among the subalterns of the home battalions.

The inconveniences of the purchase system would be reduced to a minimum by the adoption of Captain Vivian's proposal for reducing the regimental ranks.

As no increase in the total numbers of the British establishments is proposed, it is necessary to show how the men and battalions may be distributed under my scheme so as to meet the requirements of the Service.

This I have done in Tables II and IV, and it will be seen that if the composition of battalions which I suggest be adopted, there would not, in any grade, be an excess of present establishments, and consequently no increased expense.

These details may, however, be modified without affecting the principles advocated. I worked them out and have had them printed in order to satisfy the meeting that the scheme is practicable, and could be carried out without additional staff or establishments, but I do not propose to enter into explanation of them, unless requested to do so.

The only point which calls for explanation is, that I have adopted eight company battalions for two reasons—1st, to admit of an increase of battalions; 2nd, because, under present regulations, flank companies are done away with. I propose, however, to have four battalions in a brigade, in place of three.

Having settled the establishment of "battalions" and "brigades," the

next step will be to *organize* them into "divisions" and "army corps," and to settle the precise distribution of the forces.

The project for an army corps laid down in the "Regulations for the equipment and supply of stores by an Army in the field" is based on the *infantry* force, viz., two divisions (or four brigades) of infantry, of the total numbers of 10,000 men.

The units for the formation of an army corps of any required strength may be taken to be a division of infantry and a brigade of cavalry. To each of these a proportion of field (or horse) artillery and train would be attached, and a proportion of engineers would be told off to each infantry division.

So long as the proportions are laid down, and the troops are distributed throughout the kingdom so as to be readily brought together for annual exercise in those proportions, there is, I submit, no necessity for making it a condition that the forces shall be distributed in corps of "equal" strength; nor would it be practicable to do so without large expenditure in the erection of barracks, &c.

I have, therefore, prepared a project, Table IV, showing the peace distribution which I would propose. Under this project, the regular infantry would be so distributed that brigades might be annually assembled for exercise in the camps proposed for the several districts, and in four out of the six districts there would be cavalry brigades.

I have shown the number of infantry, of infantry reserves, and of militia, which I would propose to attach to each district for supervision of training, and for the purpose of being brigaded with the line. These numbers are given in the diagram before the meeting, and the distribution is further illustrated by a map, on which are shown the suggested positions of the head-quarters of districts and brigades, and of the camps.

In preparing the project I have arranged the districts mainly in reference to the railway communications and existing barrack accommodation, so placing the head-quarters that they may, as regards postal communication, be conveniently situate, in reference to the outlying brigades and stations.

Thus the southern division, with its head-quarters at Aldershot, and which would be the nucleus of an army corps of over 60,000 infantry for the defence of the South Coast, would have the command of the South-Western Railway and its branch lines.

In time of war the brigades of line regiments at Portsmouth and Gosport would join the moveable force, their places in the garrison being taken by the Pensioner Reserves and Militia and Volunteer battalions.

It would be the duty of the Generals commanding districts and of the Brigadiers to make themselves thoroughly acquainted with the whole of the defensive resources and requirements within their respective commands, including the arrangements for transport, the means of procuring at short notice additional horses for the cavalry and artillery, the positions to be entrenched, and all the numerous arrangements necessary for turning the forces under their supervision to the best possible account in the event of war or invasion.

The arrangements for the management, repair, or destruction of the railway communication within the district should be carefully prepared in concert with the officers of the railway companies, and of those of Volunteer Staff Corps who have taken up that subject.

With a peace organization and distribution of the regular and militia forces such as I have here indicated, and a corresponding organization and distribution of the cavalry, artillery, and engineer corps, there would be no difficulty in putting into the field a defensive force far in excess of the 200,000 men which was suggested as one of the conditions of our problem, nor would there be any delay or difficulty in organizing an expeditionary corps of a total number of 100,000 men.

In respect of the yeomanry and volunteer forces, all that appears necessary for their more perfect organization, is to make arrangements by which brigades formed of these forces should be manœuvred with those of the line and militia, and to place the inspection under the Generals in command of districts.

I doubt the expediency of placing volunteers in the same brigades as regular soldiers. The regulations under which they serve differ so much from those of the regular Army, and the fact of the men being taken from a different class in life, would appear to afford sufficient reasons for forming brigades of exclusively volunteer battalions. This, however, is a subject for discussion. No volunteer battalion should, I conceive, be allowed a place in a field brigade which does not come up to a certain standard of efficiency. Volunteer corps which, for want of opportunity or other causes, do not attain this standard, to be allotted with the pensioner force for the defence of fortresses, &c.

I trust I have now sufficiently explained the measures proposed for the organization of our infantry forces and our home reserves, so as to meet the propositions set before you. I have not proposed any new establishment, and although, for purposes of organization and inspection, I have proposed an addition to the number of brigades, the brigade staff may be formed by a redistribution of staff appointments.

In reference to our self-governing colonies, I have indicated (page 318) the arrangements which I propose for *training* the local reserves, their organization would be carried out on the same principle as that of the home Army, subject to modifications to meet local requirements.

In regard to the third head under which the subject of army organization has to be considered, viz., the Administrative Organization, I would, for my individual opinion, refer to the evidence which I gave before Lord Strathnairn's Committee, in 1866, page 140 of Blue Book. I then advocated the amalgamation of the Military Staff Departments, under one head, and of the Supply and Transport Departments under another.

In the field, the first of these Officers would be at the General's side to carry out his orders in respect of the movements and disposition of the combatant troops in front. The other would be charged with the equally important staff duty of bringing up the supplies from the rear.

In a garrison or military district these two staff Officers, with the

Officer commanding the Royal Artillery, being the Officer in charge of armaments, and the Commanding Royal Engineer being the Officer charged with defences and works, and a Financial Officer, who should be a civilian, would form a Council to which the General might appropriately have resort for advice on all important matters affecting his command.

I see no reason to alter the classification of duty which I then advocated, with this exception, that the civil element should not in any respect be an executive Officer, but that he should be one of the civil servants of the Crown, probably a selected clerk from the War Office or Treasury, and that his relations to the General should correspond with that of a Colonial Secretary to a Governor, with that of a clerk of a bench of magistrates to the Justices, or with that of the Assistant Under Secretary of State for War to the Secretary of State, viz., to advise the General on all matters of finance or regulation, and to carry on, under his instructions, correspondence on subjects of administration, and to issue warrants for expenditure authorized by the General under emergent circumstances without the previous sanction of the Secretary of State.

Under present regulations, when a military force is beyond the immediate control of the Secretary of State for War, the General is his representative, and it would appear to be inconsistent with that theory to give to any subordinate Officer a position or power which would imply a control independent of the General, and this would be the more objectionable in principle if the controlling Officer had to direct executive business involving the local expenditure of public money.

The suggestion I make would not involve the creation of new high appointments, and the administrative capabilities of the civil servants would be increased by their temporary employment in the capacity of Secretaries to the Generals in command of stations.

The subject of administrative organization is, however, now under consideration, and is not one on which it is proposed to invite discussion.

The CHAIRMAN.—We have to thank Major Leahy for having laid before us a very comprehensive scheme, which, as you have heard embraces a large number of subjects both of principle and of detail. The subject is a very large one; and Major Leahy has treated it with very great ability, and in a very comprehensive manner. Perhaps, the best course that we can now pursue will be, that if any points in the paper are not quite understood, and more explanation is required, gentlemen should question Major Leahy, in order that he may more fully explain them. I am rather inclined to doubt from the large area which the paper embraces, whether it can be discussed very easily without being first in print, and read by those who wish to discuss it. The paper is extremely well put together, but, as I have said, it embraces so much detail, that if I attempted to discuss it, I think I should have some difficulty in knowing how to handle some of the points, without a little more study than can be given to them upon hearing them the first time. As far as I am personally concerned, I am not prepared to enter into any discussion, or to express any opinion upon it at the present moment. Probably I should not be prepared to express any very strong opinion upon it at all, on account of the position I have the honour to hold. For whatever I might say, though it might only be in discussion,

might carry with it more weight than it might deserve, and be received as an authoritative scheme, when it would be only the opinion of an individual. I make these few remarks for the purpose of suggesting to the meeting that, as far as the discussion is concerned, we should take another day for it; but I think there are many points upon which members might wish to be further enlightened, and upon which they might now put questions to Major Leahy.

Colonel ALCOCK, Commandant 1st Regiment Middlesex Militia.—It may appear very presumptuous in me to venture to offer an opinion upon so comprehensive a paper, and one so ably written as that which we have just heard. But, perhaps, as you, Sir, have already suggested, it might be possible on a matter of detail to mention something that may be of interest to the meeting. The point of detail which I would select, is one applicable to that part of the service to which I belong, viz., the Militia. It happens to be one in which I can, I think, to a very great extent corroborate the general principles which the lecturer has laid down. One principle is, that a Regiment of Militia should consist of two battalions; another is, that the industrial employments of the men who form the Reserve, should not be interfered with. The Lecturer compared our organization in that respect with the organization of the Prussian service; but it would be more appropriate, as it seems to me, to compare it with that of the French. A good deal has appeared in the papers lately, and everybody knows, that the organization of both the French and English services has a certain similarity, inasmuch as in both, there is an active Army, and a Reserve, consisting of old and young soldiers, and a second reserve, consisting in the French, of the *Garde Mobile*, and in the English, of the Militia, the Rifle Volunteers, and the Pensioners. The French organization is strong, because it is based upon the conscription. The English organization is weak, because it is not based upon the Militia, which is the old constitutional Army of the nation. Now, what I wish to point out is—not that I am so well prepared, perhaps, as I ought to be to speak upon the subject,—but I think I can show distinctly that the view which the Lecturer has taken is perfectly sound, and applies most particularly to the Militia Service. The Militia, as we all know, is called out for twenty-eight days' service in the year. It consists of men who can give twenty-eight consecutive days from their employment; therefore, it includes that class only, and no other. If you wish to increase your members, you must include a larger class. The gallant Officer has said that the industrial employments of the men should not be interfered with. And here we come to the rule, that when you want a larger number of men, you must consider the relation which the pay and the period of military service bear to the wages and the demands of civil employment. You must consider both, or else you cannot get the men. The Militia are expected in times of emergency, in times of war, to supply the line with drilled men, and at the same time to keep up their own establishments; two things, which we know from our experience in the Crimean War, are almost impossible. It was done, but only with great difficulty. Under the present system of warfare, it would be still more difficult, because things must be done much faster than they were formerly. To succeed, we must depend entirely upon organization, and not upon money. The idea seems to be prevalent that, being a very wealthy country, if it comes to a push, we could, by trusting to the pluck of our men, and to a lavish expenditure of money, accomplish anything. It is my firm conviction that this is a mistake, and that we must trust to organization. That remark brings me back to the subject of organization. For the Militia to supply the line with trained men, and to keep up their own establishments, they require themselves to have a Reserve. Consequently, instead of our organization being similar to that of the French Army, namely,—

Active Army,
Reserve of old and young soldiers, mixed,
National Guard Mobile,

the English ought to have been as follows:—

Active Army and Army Reserve,
Militia and Militia Reserve,
Rifle Volunteers and levy *en masse*.

The effect of having a Militia Reserve would be this; that those men who are unable

to give 28 consecutive days' training, whose civil employments would prevent their doing so, would be in the Militia Reserve. Of course, anybody may say: but how would you manage all this? I can assure you that the thing is so simple, that it is wonderful beyond measure that it has never been adopted. The fact is, that we are actually training and selecting men whom we are unable to keep, because militia regiments cannot have in their ranks, men who cannot give those 28 consecutive days' training, and well drilled and equipped men, of excellent character, are obliged to leave the militia, and this at the very time when there is some talk of an increased capitation tax in order to increase the number of the rifle volunteers. I should not like to speak in excess of the number, as it is impossible to know very accurately, but upon an average from 30 to 40 well-trained men, of excellent character, fully equipped, leave the militia regiments every year, merely because they cannot give 28 consecutive days to training with their regiments. The state of the case is simple enough. If you want to retain these well drilled men, many of whom would gladly serve in their regiments if embodied, your plan would simply be to put them into the "Militia Reserve." If you ask me how the Militia Reserve is to be managed, I say, manage it in the same way as the Rifle Volunteers are managed; you are doing all you can to increase the Rifle Volunteers. I say give us a Militia Reserve in every respect the same as the Rifle Volunteers; deal with the men as you do with the Rifle Volunteers. Let men be attested for either the Militia or the Militia Reserve, and let those whose masters will not allow them to serve 28 days, go into the Militia Reserve. I think I collected from what the gallant Officer said, that the Staffs are expensive, and that it might be a question whether the Staffs could not be reduced. I think it would be much better policy, not to reduce the Staffs, but to increase the amount of benefit which the country should receive from their services. You have got excellent Adjutants and excellent Staffs, make them also the staff of the Militia Reserve. There is likewise some talk about the want of promotion in the Militia; that difficulty might be easily overcome. Only let some efficient lieutenant who resides upon the spot, undertake to form a company, and when he has got a company for the Reserve then let him have his promotion. By this means you would increase the chances of promotion. Without going further into the subject, I can assure you that if any one will consider it thoroughly, he will see that there is great truth in the view I have put before you, that the efficiency of our Army, both for internal and external action, would be much greater with that simple alteration which I propose. It is an extraordinary thing that we actually have the men, but we do not keep them; all I propose is that they should be kept. If the subject were to be examined, it would be found that I am right in what I have said. It would entail no expense whatever, although I am far from advocating that expense should not be incurred when necessary; the country is rapidly increasing in wealth, and the cost incurred in organizing for its defence, is the insurance we pay on our national wealth, which has been increasing at the rate of £120,000,000 per annum, while our rate of insurance is not increasing at all. No one can foretell what may happen, no one can forecast political or commercial events, and should any eventuality arise, our Army Organization ought to be commensurate with the magnitude of the interests at stake.

The CHAIRMAN: I would remind the meeting that Major Edwards' paper is also before it. Everybody is cognisant of it, and in any remarks made upon that paper, in combination with that of Major Leahy's, I hope that the whole subject will be dealt with.

Captain J. B. ROBINSON, Northamptonshire Militia: Perhaps I may be allowed to say a few words, principally in support of what the last speaker has said with regard to the Militia. I think we have been very much misled by the use of the word "Reserve," in fact we have no Reserve properly so-called; we have no Army Reserve that can be moved out of the country. We have merely got a local Militia, in the old sense of the term, and the Volunteers. Colonel Alcock stated that Militia regiments did volunteer to serve in the Crimea. That was done under a special Act of Parliament, and it would require another Act of Parliament to enable them to volunteer for foreign service at the present time. Before any reform in the auxiliary services of the Army can be made, it should be known what we want. There is confusion in our ideas as to the Militia. Some officers look upon the Militia as a service

that is merely a nursery for the line, while Militia Officers probably look upon the Militia as a Service in itself, which is to be kept intact, and in the finest working order possible. No one can blame the Militia officer for being jealous for the efficiency of his own *corps*. Until we arrive at some idea of what we want—whether the Militia is to be simply a nursery for the line, or whether it is to be a local force ready to garrison England, and so far to act as a reserve to support the regular Army by service at home in garrison duty—we shall never come to any satisfactory decision. The Militiamen, as to rank and file, I believe to be of very good stuff indeed, but many of the Militia Officers are men who have had no opportunity of learning their duties. The Officer is called out for 28 days; he finds half the regiment, or one-third of the regiment consists of recruits, and the others, men who were well drilled a year ago, but who have, perhaps, half forgotten their duties. The sergeant-major and the adjutant, naturally and properly, think more of forming the men than of forming the officers. Unless the officers have an opportunity of being attached to regiments of the line, and thus learning their duties, we shall never have them efficient, and we shall never get an efficient regiment.

Major LEAHY: With reference to a Militia reserve, it must be borne in mind that the militia consists at present of 120,000 men, with power to raise it in time of war to 180,000 men. These additional 60,000 men might be enrolled in a Militia Reserve. There is a further power to enrol and train 200,000 men under the Act of 1806.

Colonel ALCOCK: The authority does not exist for having any Militiaman if he cannot serve the 28 days. After the man's period of service has expired, he retires, if it has interfered with his civil employment, and if during the five years of his engagement as a militiaman he gets a good situation, he is entitled to leave the service upon paying 18s. 6d. My view is that such well drilled men ought not to be allowed to leave, but ought to fall back into the Reserve, and be treated like Rifle Volunteers.

The CHAIRMAN: The great object, as I understand, of the two papers laid before you is "Organization." There is no doubt that what the gallant officer, Colonel Alcock, has brought before you, is most worthy of consideration; it is a most important part of the subject. There is no doubt whatever that the militia are under considerable difficulties: in the first place from being called out at particular periods of the year for 28 days, people have to leave their industrial occupations, and consequently are often obliged to give up their militia service rather than lose their industrial employment; and, in the second place, there is also a great difficulty with regard to the officers. We have heard a good deal of "the county connection." The "county connection" has been hitherto a most important element in the militia, but I am afraid that those who study the Army List and look at the requirements of the Militia, will find that that service at the present moment is not quite so popular a service as it should be, with those who live in the different counties. The militia is very short of officers, very short of subalterns, and in some instances, I am afraid, very short of captains. As I said before, however, the great problem brought, first by Major Edwards, and secondly by Major Leahy, before this Institution, is a system of "organization" which shall make our forces more useful both in time of peace and in time of war. At the present moment I am not quite prepared to say in what particulars the difference between the two papers consists. Major Leahy distinctly goes in for two battalions, a battalion for home and a battalion for Indian or Colonial service. I think Major Edwards divides his into three classes, [Major EDWARDS: As regards the reserves I make no change whatever.] and in another form of organization that they should be "divisionized" in different parts of the country; that the militia should be occasionally formed up with the line, and that there should be a system of brigades and divisions in different parts of the country. That I understand to be part of the system which is advocated, a system which is obviously necessary to make our forces more efficient, to bring the staff into greater play, to have the duties more adequately performed, and also what is still more important, to enable those in charge of certain portions of the country to know exactly what the resources of those parts are, supposing the troops were suddenly called out. Those, as far as I can understand, are the chief features of the subject brought before us. The two papers certainly require very minute study for the purpose of thoroughly com-

prehending what are the different objects proposed by the two lecturers, and for the purpose of bringing a useful discussion to bear, with the view of seeing what would be the best system of army organization for the country.

Major EDWARDS: We are going, I think, rather too much into detail, and keeping away from the general principles which I tried to establish. Perhaps, as some of the members present may not have read my paper, I may mention two or three points in it. The principles are :—

1st. To concentrate the army to a greater extent in the United Kingdom.

2nd. To divide it into *corps d'armée* of equal strength, and distribute it with reference to them.

3rd. To organize the militia and yeomanry, so that they can readily join the regular *corps d'armée*.

4th. To give to the field artillery an organization which will render it capable of rapid expansion.

5th. To form dépôts for the establishment and instruction of a reserve of trained men for the different services.

Anybody who considers the want of organization in our Army at the present moment, can, I think, only come to the conclusion, that these are the *five principal steps* that are necessary for putting us in a position to turn out all our forces in the shortest possible time, either for the defence of the country, or for the despatching of expeditionary corps to different parts of the world. To divide our Army into *corps d'armée* of equal strength, is, I think the most important step. The administrative units of an Army vary according to different circumstances, and may be as in ours, a battalion of infantry, a regiment of cavalry, or a battery of artillery. But the tactical unit of an Army is the same for all modern Armies, or nearly so; it is generally called the *corps d'armée*. It is composed of all arms of the Service, infantry, cavalry, artillery, engineers, military train, in proper proportion to one another. Now, if these tactical units are not organized in time of peace, it is impossible that an Army can be effective in time of war. This I hold to be a most important point in considering the organization of an Army. Because if you are suddenly called upon for defensive warfare in this country, or warfare abroad, and your tactical units are not kept up in time of peace, you cannot create them in time of war. This happened to a certain extent in the Crimean war. We sent out that expedition by battalions of infantry, regiments of cavalry, and batteries of artillery, and all the odds and ends of the Service. First of all, we occupied Malta, where these forces were formed into brigades and divisions. Then they were pushed up further to the front. Our present system obliges us to occupy some safe spot outside the enemy's frontier in order to form our Army, before we are in a position to use it for hostile purposes. If we do not form our Army to a certain extent in this country, it is quite impossible, when war breaks out that we can despatch an expedition abroad, perfect, complete, and ready to undertake such hostile operations as its strength will allow of. Therefore I hold that it is absolutely and indispensably necessary that the tactical units of our Army must be maintained in time of peace.

In talking of the Militia and Volunteers, the subject, generally, is not considered in a comprehensive spirit. People generally run off into "Reserves" without knowing that the whole of the Reserve forces must be capable of being fused together into one mass at a moment's notice for use. It is no use your having an indefinite number of battalions of Militia, Volunteers, and regular troops, unless you have all the different arms of the Service tolerably proportioned to one another. For that reason it is absolutely necessary to organize the militia and yeomanry, so that they can easily join the regular *corps d'armée*.

The great object in view, is to be able at once to place the regular Army of this country on a war footing, ready to commence a campaign at once; so that the War Minister, from his office in London, with the Commander-in-Chief, could, in two or three days, bring forth all our defensive power. At the present moment I need hardly tell you what a state we should be in, if this country were really invaded. If a thoroughly organized Army of 80,000 men were to land on our shores, we should find it very difficult to make any show against it. If the country were threatened with invasion, we should call out our Militia, Yeomanry, and Volunteers. But

before they could become of any use, they would have to receive an Organization corresponding to that of a regular Army. The present regular Army would become the nucleus for the formation of *corps d'armée*.

Colonel ALCOCK : I should like to ask, whether I understood rightly, that each regiment of militia was to have a second battalion ?

Major EDWARDS : Yes, each regiment of militia. There are 135 regiments at the present moment. Instead of that, I would have 60 regiments of three battalions.

Colonel ALCOCK : So I collected. As the object which you wish to obtain is the mobilization of the militia, it depends upon minute details. I should like to state that it is essential that each particular Militia Regiment should have its Reserve. The reason is very obvious, and it would carry the more weight, because it would be a direct saving to the country. It would be a saving to the country in two respects. In the first place, the country would get more for its money ; and in the next, in the event of war—everybody who has any knowledge of what occurred during the Crimean War will know this—that when a militia regiment was embodied, and became equivalent to a regiment of the line, the wives and children of the married men being left behind, became a very heavy charge upon the State. If there had been a Militia Reserve regiment, as there ought to have been, the married men would have been transferred to the reserve, and the single men would have gone from the reserve into the regular army.

Major EDWARDS : That point I meet by having each regiment to consist of three battalions. The first battalion would consist of men who would serve and undergo a considerable amount of training. If you take three regiments as they are now, three county regiments, and fuse them into one regiment of three battalions each, the first battalion will consist of men who will undergo more efficient training, and who will be ready at a few days' notice to join the regular Army ; the second battalion will be available to undertake garrison duty—they would not require the training of the first battalion, and that meets the question of keeping the men who could not afford to give up twenty-eight days to training ; the third battalion would be the reserve, who would answer all the purposes which Colonel Alcock has suggested.

Colonel ALCOCK : I admit that the theory is perfect, but I must be excused for saying that I doubt its efficacy in practice. The present system, as it is, is perfect, if you would only use it ; leave the regiments as they are, and give them a reserve, and you will have them ready to bring out at a moment's notice. At this very moment we are discharging men from many regiments at the rate of forty men in the year, well-trained men : those are the men I want to put into the reserve.

Captain ROBINSON : With regard to putting the married men into the Reserve, I know one village in the midland counties, where all the married men volunteered for service in the Mediterranean, and all the unmarried men joined the dépôt.

The CHAIRMAN : I think we have laid the foundation to-night for a good discussion. The two papers should be read attentively by all who wish to take part in the discussion, I trust that when we meet again, we may have a good discussion upon the merits of the proposed systems of organization. There are many points, no doubt, of detail, as you have just now heard ; but they are, if anything, points for the office—one might almost say,—rather than for a discussion on the broad question. The question before us is organization upon a great scale, and our discussion should be mainly upon that. If it is agreeable to all, we will adjourn to Thursday week. I conclude by saying that you will permit me to express the thanks of the meeting to Major Leahy, as well as to Major Edwards for the papers which they have laid before us. They will be most useful I am sure to the Service.

The meeting was then adjourned to Thursday, May 7th.

Thursday Evening, May 7th, 1868.

ADJOURNED DISCUSSION ON "AN ORGANIZATION FOR THE ARMY OF ENGLAND."

COLONEL THE RIGHT HON. THE EARL OF LONGFORD, K.C.B.,
in the Chair.

The CHAIRMAN: The discussion this evening is a continuation of that which commenced here a few evenings ago on papers read by Major Edwards and by Major Leahy, R.E. I take the chair under some disadvantage, from not having been present on the former occasion. I am, therefore, rather in a position to listen than to take any part in the discussion. I have been requested by the Council to state that the points which are embraced in these papers are of sufficient importance in themselves to occupy our attention this evening; but there are various other points of military interest which will be postponed for separate discussion on a subsequent occasion. I invite gentlemen to make remarks upon the following propositions which have been laid down. Moreover I trust, that they will confine themselves to these points.

MAJOR EDWARDS' PAPER.

Propositions—

1. To concentrate the Army to a greater extent in the United Kingdom.
2. To divide it into *corps d'armée* of equal strength, and distribute it with reference to them.
3. To organize the Militia and Yeomanry, so that they can readily join the regular *corps d'armée*.
4. To give to the field artillery an organization which will render it capable of rapid expansion.
5. To form depôts for the establishment and instruction of a Reserve of trained men for the different services.

MAJOR LEAHY'S PAPER.

Propositions—

1. That in order to increase the means of organizing Army corps, each regiment should consist of two or more battalions, one for home service, the other for colonial service; and that a proportion of the Army Reserve force should be attached to the *home battalions* sufficient to make up *both* battalions to the war establishment.
2. One or more divisions of regular forces to be quartered in each military district, to form the nucleus of an Army corps with *staff complete*. Supervision of all enrolled auxiliary forces to be intrusted to General Officers of districts and their brigadiers.
3. Portion of the regular and auxiliary forces in each district to be annually encamped and formed into brigades, and manœuvred with due proportion of cavalry, artillery, engineers, and train.
4. The foregoing propositions will not involve new legislation, or radical re-organization of the Militia.

Major-General BOILEAU, R.E., F.R.S.: It was hardly my intention to take part in this discussion, because the subject is one of so purely a military character, and belongs more properly to those who have served with armies in the field, that I feel great diffidence even in expressing any opinion upon it. In order, however, to break the ice, and to prepare the way for those who are better qualified than I am, I will make a few observations upon one or two points contained in this schedule. With regard

to the concentration of the army, I think that Major Edwards' paper embraces all that is necessary to be brought forward in a general point of view. With reference to the division of the forces into *corps d'armée* of equal strength, and their distribution, the proposal is one in which I believe most persons will be inclined to agree with Major Edwards. There are one or two points with reference to details which in reading over the paper, have struck me. One is with regard to the military train. The number of men included in each *corps d'armée* appears to me to be insufficient for general purposes. The number in the Prussian Army, which has lately shown itself in the field to be excellent in all its details, is about three and a half times the strength of the military train proposed here. But if, by the expression "military train," I am to understand that it is to consist of wheel carriages drawn by horses, I must say that, however much such a system might apply to countries where roads are in existence, or where they can be made as required, there is no doubt that wheel carriages, with horses to draw them, form an excellent military train. But there are other countries where trains of that kind would, in my opinion, be inapplicable; therefore, for that portion of the Army which Major Edwards proposes to keep in India, I do not think a military train composed exclusively of wheel carriages drawn by horses would be applicable. Those who have served in India will remember that, for the carriage of camp equipage and of a large portion of the baggage, the military train consisted entirely of camels. The camel is an animal that has not been inappropriately called the ship of the desert. Its services may be made available in many ways. For instance, camels can be applied to guns; they can be applied to carriages; they can also be applied to the carriage of baggage of all descriptions, if not very large and heavy; and they can be used in transporting troops rapidly from one place to another. Therefore, I think, in all military trains which are to be organised in India, camels should form a very large portion of that train. With regard to the Abyssinian expedition, and what has fallen from the talented author of the first paper upon that subject, I do not think that a military train would have suited the requirements of such an expedition. There were no roads even from the sea-side, and pack animals had to be used there. Approving, as I do entirely, so far as I am able to judge, of the system here proposed, I think there should be some reservation made with respect to the military train, especially for service in India, and also in such countries as Abyssinia, where you require a special organization for each. The next point is one which relates to the organization of the militia and yeomanry, so that they can readily join a *corps d'armée*. That is a question upon which I forbear speaking; also with regard to the organization of the artillery, which is a question for artilleryists, not engineers. With regard to depôts, I think the system proposed is an excellent one. I would observe, however, with all deference to the author of this paper, that for the instruction of engineer soldiers and recruits, depôt companies are not sufficient. You require scientific instruction in the Engineers as well as in the Artillery; therefore the troops should be organized and instructed at fixed establishments, and in larger numbers than can be brought together in depôt companies. Those are questions of detail. As far as I have been able to study the paper, and to understand its details, I do think it forms a very excellent groundwork for future action, by those in whose hands will rest the organization of our forces. The idea that we should supplement our regular forces by reserves of militia and yeomanry is a very good one; and the project which purposes to give us an Army of 160,000 men instead of 80,000 appears to me to be within the practicability of our present establishment. The only other point which I would wish to refer to is that of using native troops in hot countries to assist Europeans. I think the suggestion is a very good one. It is not altogether new, but the view which Major Edwards takes of it—that of supplementing the service of Europeans by that of natives—is, in my opinion, one which is very sound, and which would lead to the most useful results. I have not had time to study Major Leahy's paper, which contains more statistics than this does. The observations I have offered to the meeting were merely intended to lead the way for others of more matured and greater experience, to give their opinions. Having done this, I trust that others will continue the discussion, and favour us with their views upon this most interesting subject.

Major Sir HARRY VERNEY, Bart., M.P.: Having been called on to say a few words upon this most important and most interesting subject, I feel that I do so under greater disadvantage than many Officers present, who have given their minds to this matter, and particularly those who had the advantage of having heard those papers read on which I understand the discussion is now to be taken. Certainly, it is a subject which has always peculiarly interested me from my very boyhood; because I recollect as a boy going with my father to the different points in the south of England where it was proposed to concentrate troops at the time that the French army was concentrated at Boulogne, and we had reason to expect an invasion. I recollect going with him along the different lines of hill on the south coast of England, and his showing me the different points that were to be taken up, and the towns and villages where the magistrates and others had orders to collect depôts, and to take all precautions for the defence of the country. I recollect a little old man coming into my father's room at the Horse Guards one day, and saying, "Sir, I have got 80 waggons, with 8 horses each, and drivers, which are at the disposal of the Government to go at any moment to any part of the country where they are wanted." Some of the older gentlemen present will recollect "Russell's flying waggons." It appears to me that the important thing for us to consider is, what would really happen in case this country were threatened with invasion? I believe that there would be an endeavour to collect hostile fleets at several different points on the coasts opposite to our own; that we should be threatened not with one invasion, but with several invasions. I imagine nothing would be easier, should we ever go to war with France, than for several corps of the French Army to be collected, who would be ready to throw themselves *perdus* upon our coast; every man of them would be perfectly satisfied though he expected never to return. Now, there is the danger we have to look in the face. Do not let us think that it will be anything less than that. There would be several *corps d'armée*—four, five, or six—prepared on the opposite coasts to throw themselves upon different points of the coast of England; and if two out of these could effect a landing they would be satisfied with their success. We all know that in foggy or bad weather there is nothing to prevent an Army landing anywhere, particularly when we have seen how rapidly armies may be embarked. Who will say that if five or six different bodies of the enemy were prepared to cross, two or three of them would not succeed in effecting a landing? That is the danger which I believe we have to provide against. Of course the existence of railways would be of very great importance in resisting any such attack. Sir Willoughby Gordon made a very true observation when he was asked, "What is the inconvenience of diversity of gauge?" "I think the inconvenience would be that of a ferry; if you have to change all your material of war and troops from a railway of one gauge to a railway of another gauge; it would entail a very inconvenient operation, and cause serious delay." I hope, indeed I suppose it cannot be doubted, that those in authority have made their preparations, and have mapped out the country in a way which has been decided upon after the consideration of how an attack of this sort could be resisted. It has always appeared to me a matter of great importance that those who would be the first to throw themselves on any point of danger—I mean our Volunteers and Militia—should have their efforts wisely directed. What I should be afraid of, in any event of this sort happening, would be that they would expose themselves injudiciously, and our best and most valuable men be shot down and destroyed. Therefore, means should be taken before-hand to enable the Militia and the Volunteers to act with the regular Army. Moreover, if a staff could be formed, so that it would not be necessary to take away the staff from the regular Army force, where in time of war it would be wanted, if a staff could be provided from these Reserved Forces themselves, I think that would conduce very much to the efficiency of the Volunteers and Militia. There are other points which have suggested themselves to my mind also, but this is not the time for discussing them. This is not the proper time for discussing, for instance, the soldier's period of service in the Army. But it must be evident to every one that it is the system of "short service" in the Prussian Army which enables large forces to exist in that country. The real success of Prussia at this moment is due to General Scharnhorst, who, after the battle of Jena, when Napoleon said, "You shall only

"have 42,000 men in the Prussian army," took care to change the 42,000 men every five years; so that when the time of war came, Prussia had a large Army ready to take the field. This is not the time, however, to discuss that question, but I trust that it will not be overlooked by those who have the management of the Army.

A MEMBER: Am I to understand the honourable gentleman who has just sat down to say that he considers the conscription desirable in this country, as they have it in Prussia? I do not see how we can do without it.

SIR HARRY VERNY: I think every man in this country is bound to be ready to serve his country when danger is at hand.

Colonel EWART, R.E.: I think, my Lord, that the papers before us present so many subjects for discussion, that the principal difficulty for those who attempt to enter upon the question would be to confine themselves to the particular points that we have to discuss. For myself I have followed the last speaker along the south coast of England, although far more recently. I have studied the different preparations which were made at the time of danger in order to provide against invasion, and I must say, from what I saw, considering the circumstances of that time and the difficulties of communication, that they were very perfect. In the present day we are under far greater advantages, because we have such ample railway communication. We have opportunities of rapidly sending forces from one part of the country to another. But what we want is, to picture to ourselves what may happen and what would be required. In considering these papers, I must say I think, considering the requirements of our Army, that the organization by *divisions* is more possible than the organization by *corps*. We may say that in Ireland we have about a *corps*, but in England I think it very difficult to establish a *corps* organization. With the requirements of our colonial duty, with the requirements of India, with the various expeditions which we have to fit out for foreign service, all these expeditions being under different circumstances, I think that the working by *corps* would practically be found next to impossible. The system of working by divisions, which was adopted in this country to a large extent after the experience of the Crimean war, appears to me to be one which is very possible, and which may even be carried out to a greater degree than it is at present. The principal thing that we want in the divisions is more of the administrative element. We have plenty of the moral element; we have got an efficient staff, and, thanks to the Staff College, experience in late wars; we have a considerable reserve of Staff Officers, who could be readily called out if they were required. There is another point in Major Edwards' paper which he dwells upon, which is that of reducing our forces very considerably abroad, in order to have more at home, and largely employing native troops. That subject has been lately very carefully considered by a Parliamentary Committee. Having taken great interest in the subject, I have looked at their conclusions, and I must say they come very much to what I have always thought. It appears to me that in some of the colonies, such as the Mauritius, China, and Ceylon, native troops to a certain extent may be employed with great advantage. But there is that difficulty, that if you move troops from India to those colonies under the circumstances of the Indian Army, you have forces with Officers at a high rate of pay doing duty with British Officers of the ordinary English Army; and then, immediately, arises the difficulty of these Officers being paid upon different scales. Therefore, if you adopt this system, you must do it very much by raising a force for employment in those colonies, and instead of the colonies contributing as they do at present a certain sum which is carried to their credit, possibly the colonies might directly pay those troops. With regard to the remarks in the paper of Major Edwards' upon the Abyssinian expedition, it appears to me that to have sent, as he suggested, a *corps* direct from any place to carry out that expedition would not have been so successful a plan as the one adopted, because it is a country that required an Army with a peculiar organization. You sent there the particular kind of troops required, and you formed up your Army with such troops as were most suitable for working in that country. For instance, in one country you require a large proportion of men who are able to work in a cold climate, and work in the hills. Under other circumstances you might have to employ troops that are more accustomed to work in the plains. With regard to what was said just now upon the subject of the military train, it appears to

me that if you had sent a good and efficient body of military train out there they would have been very valuable ; but I do not think it follows that because you send a military train you should send them with a very full equipment of waggons. But you send non-commissioned Officers and men who are accustomed to transport duties, and those men form the nucleus of a transport *corps*. I apprehend in the proportion that has been laid down for a military train, for a *corps d'armée*, that it is quite understood that that is to be a nucleus, and that you would build upon that from the resources of the country. I must say, supposing we were called upon for the purpose of defence in this country, that with a good nucleus for a military train we should very rapidly place ourselves in a position to go anywhere and do anything. With reference to the third point, the organization of the Militia and Yeomanry, so that they can readily join the regular *corps d'armée*, I must say that I think it is of the greatest possible importance that the Reserve Forces should be made to lean more than they do now upon the regular forces. I think that instead of having a ~~large~~ gathering of reserve troops from different parts of the kingdom for a review, it would be very much better if you had reviews in different districts ; and the regular troops in those districts and the reserved forces in the same districts would work together under the General Officer who is charged with the ordinary division duties of the district, and who naturally has under his immediate consideration all the defensive requirements of that district. I think the more these Reserved Forces are made to lean upon the regular forces serving in the same district, the more valuable they would be if we were suddenly called upon to meet an emergency. We must consider that in these days we must be prepared for organizing very rapidly. If anything were required it would be required in a hurry, and, as has just been suggested, we may be attacked at a number of different points, and we must be prepared with large forces organized and in suitable positions, to throw them upon those points ; our railway system must be very carefully studied ; we must be prepared rapidly to form such *corps* as the Prussians had for breaking up or for repairing railways.

The first point in Major Leahy's paper, and it is a very strong point which he brings forward, is that he proposes a new system of effecting colonial service. He proposes, in fact, that a Regiment should consist of two or more battalions, that one battalion should be at home, that another battalion should be upon colonial service. We have practically tried this system in the Crimean war. It was actually in operation in the Guards. Each of the regiments of Guards sent one battalion out and formed a brigade, and the battalions abroad were fed with recruits by the battalions at home. I believe the system was found to work very well ; certainly the battalions abroad were always kept very efficient, and were readily supplied with Officers and men from the home battalions. Major Leahy proposes to extend that system to the colonial service. He proposes that there should be an interchange going on ; the men would be so many years doing duty in the battalion abroad, then they would come into the home battalion, and would serve a certain time there, and then they would either go into the Reserve or be discharged. The only question in it that one has to consider, is that it is a very great change, and in all great changes probably it is better that they should be tried to a certain extent, in the first instance, rather than be very generally adopted. The third point in Major Leahy's paper which we are invited to discuss is, "portion of the Regular and Auxiliary Forces in each district to be annually encamped and formed into brigades, and manœuvred with due proportion of cavalry, artillery, engineers, and train." I think that is an excellent suggestion if it can be arranged in districts, if the country is suitable for the purpose, and camping ground can be obtained, and the Reserve Forces can be brought together for this purpose, as is now being done with the Militia at Aldershot. I think it is exactly what we want for making these auxiliary forces work well with the regular forces, and be prepared to take their places with them rapidly in case of emergency. I must say that I think both these papers are extremely interesting, that they show great research, and are very valuable as records.

Colonel ROBERTSON, Commanding 2nd Battalion, 8th Regiment: My Lord, there is one point in these papers that I have thought somewhat about, and perhaps your Lordship will permit me to state the opinion I have arrived at. I do so with the more confidence, because I find that I have practically come to the same conclusion that

"have 42,000 men in the Prussian army," took care to change the 42,000 men every five years; so that when the time of war came, Prussia had a large Army ready to take the field. This is not the time, however, to discuss that question, but I trust that it will not be overlooked by those who have the management of the Army.

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Colonel EWART, R.E.: I think, my Lord, that the papers before us present so many subjects for discussion, that the principal difficulty for those who attempt to enter upon the question would be to confine themselves to the particular points that we have to discuss. For myself I have followed the last speaker along the south coast of England, although far more recently. I have studied the different preparations which were made at the time of danger in order to provide against invasion, and I must say, from what I saw, considering the circumstances of that time and the difficulties of communication, that they were very perfect. In the present day we are under far greater advantages, because we have such ample railway communication. We have opportunities of rapidly sending forces from one part of the country to another. But what we want is, to picture to ourselves what may happen and what would be required. In considering these papers, I must say I think, considering the requirements of our Army, that the organization by *divisions* is more possible than the organization by *corps*. We may say that in Ireland we have about a *corps*, but in England I think it very difficult to establish a *corps* organization. With the requirements of our colonial duty, with the requirements of India, with the various expeditions which we have to fit out for foreign service, all these expeditions being under different circumstances, I think that the working by *corps* would practically be found next to impossible. The system of working by divisions, which was adopted in this country to a large extent after the experience of the Crimean war, appears to me to be one which is very possible, and which may even be carried out to a greater degree than it is at present. The principal thing that we want in the divisions is more of the administrative element. We have plenty of the moral element; we have got an efficient staff, and, thanks to the Staff College, experience in late wars; we have a considerable reserve of Staff Officers, who could be readily called out if they were required. There is another point in Major Edwards' paper which he dwells upon, which is that of reducing our forces very considerably abroad, in order to have more at home, and largely employing native troops. That subject has been lately very carefully considered by a Parliamentary Committee. Having taken great interest in the subject, I have looked at their conclusions, and I must say they come very much to what I have always thought. It appears to me that in some of the colonies, such as the Mauritius, China, and Ceylon, native troops to a certain extent may be employed with great advantage. But there is that difficulty, that if you move troops from India to those colonies under the circumstances of the Indian Army, you have forces with Officers at a high rate of pay doing duty with British Officers of the ordinary English Army; and then, immediately, arises the difficulty of these Officers being paid upon different scales. Therefore, if you adopt this system, you must do it very much by raising a force for employment in those colonies, and instead of the colonies contributing as they do at present a certain sum which is carried to their credit, possibly the colonies might directly pay those troops. With regard to the remarks in the paper of Major Edwards' upon the Abyssinian expedition, it appears to me that to have sent, as he suggested, a *corps* direct from any place to carry out that expedition would not have been so successful a plan as the one adopted, because it is a country that required an Army with a peculiar organization. You sent there the particular kind of troops required, and you formed up your Army with such troops as were most suitable for working in that country. For instance, in one country you require a large proportion of men who are able to work in a cold climate, and work in the hills. Under other circumstances you might have to employ troops that are more accustomed to work in the plains. With regard to what was said just now upon the subject of the military train, it appears to

me that if you had sent a good and efficient body of military train out there they would have been very valuable; but I do not think it follows that because you send a military train you should send them with a very full equipment of waggons. But you send non-commissioned Officers and men who are accustomed to transport duties, and those men form the nucleus of a transport *corps*. I apprehend in the proportion that has been laid down for a military train, for a *corps d'armée*, that it is quite understood that that is to be a nucleus, and that you would build upon that from the resources of the country. I must say, supposing we were called upon for the purpose of defence in this country, that with a good nucleus for a military train we should very rapidly place ourselves in a position to go anywhere and do anything. With reference to the third point, the organization of the Militia and Yeomanry, so that they can readily join the regular *corps d'armée*, I must say that I think it is of the greatest possible importance that the Reserve Forces should be made to lean more than they do now upon the regular forces. I think that instead of having a *large* gathering of reserve troops from different parts of the kingdom for a review, it would be very much better if you had reviews in different districts; and the regular troops in those districts and the reserved forces in the same districts would work together under the General Officer who is charged with the ordinary division duties of the district, and who naturally has under his immediate consideration all the defensive requirements of that district. I think the more these Reserved Forces are made to lean upon the regular forces serving in the same district, the more valuable they would be if we were suddenly called upon to meet an emergency. We must consider that in these days we must be prepared for organizing very rapidly. If anything were required it would be required in a hurry, and, as has just been suggested, we may be attacked at a number of different points, and we must be prepared with large forces organized and in suitable positions, to throw them upon those points; our railway system must be very carefully studied; we must be prepared rapidly to form such *corps* as the Prussians had for breaking up or for repairing railways.

The first point in Major Leahy's paper, and it is a very strong point which he brings forward, is that he proposes a new system of effecting colonial service. He proposes, in fact, that a Regiment should consist of two or more battalions, that one battalion should be at home, that another battalion should be upon colonial service. We have practically tried this system in the Crimean war. It was actually in operation in the Guards. Each of the regiments of Guards sent one battalion out and formed a brigade, and the battalions abroad were fed with recruits by the battalions at home. I believe the system was found to work very well; certainly the battalions abroad were always kept very efficient, and were readily supplied with Officers and men from the home battalions. Major Leahy proposes to extend that system to the colonial service. He proposes that there should be an interchange going on; the men would be so many years doing duty in the battalion abroad, then they would come into the home battalion, and would serve a certain time there, and then they would either go into the Reserve or be discharged. The only question in it that one has to consider, is that it is a very great change, and in all great changes probably it is better that they should be tried to a certain extent, in the first instance, rather than be very generally adopted. The third point in Major Leahy's paper which we are invited to discuss is, "portion of the Regular and Auxiliary Forces in each district to be annually encamped and formed into brigades, and manœuvred with due proportion of cavalry, artillery, engineers, and train." I think that is an excellent suggestion if it can be arranged in districts, if the country is suitable for the purpose, and camping ground can be obtained, and the Reserve Forces can be brought together for this purpose, as is now being done with the Militia at Aldershot. I think it is exactly what we want for making these auxiliary forces work well with the regular forces, and be prepared to take their places with them rapidly in case of emergency. I must say that I think both these papers are extremely interesting, that they show great research, and are very valuable as records.

Colonel ROBERTSON, Commanding 2nd Battalion, 8th Regiment: My Lord, there is one point in these papers that I have thought somewhat about, and perhaps your Lordship will permit me to state the opinion I have arrived at. I do so with the more confidence, because I find that I have practically come to the same conclusion that

Major Leahy and the gallant Officer who has just spoken have arrived at. I find in Major Leahy's paper that he proposes, that each regiment should consist of two or more battalions, one for colonial service, another for home service; and that a proportion of the Army of Reserve should be associated with it. It has always appeared to me that an organization in two or three battalions—I think myself three battalions—would be particularly suited to the circumstances of our Army. I also think it would be a very great advantage if, say one battalion of Militia could be connected with this force of three line battalions. I am aware there would be great difficulties in carrying out such a composition. You would require to reduce some regiments and to amalgamate others. Of course, there is the great objection that Officers would have to move about from one battalion to another, which some Officers might think would tend to destroy that *esprit de corps* which has always been considered a very strong point in our system. However, we find in the Guards, we find in the 60th Rifles, and in the Rifle Brigade, to say nothing of the regiments which have recently been increased to two battalions, that this effect is not produced. We find that these regiments are organized in two or three battalions, and that the Officers shift from one to another, and that nevertheless an *esprit de corps* exists in them, quite as distinct and quite as strong as that which exists in any single battalion regiment. The *esprit de corps* in the 60th Rifles, for instance, is not different in kind, or in degree from that which exists in any distinguished single battalion regiment, say the 42nd Highlanders, or the 52nd Light Infantry, therefore, I do not think that would be a valid objection. With respect to recruiting, there might be some difficulty. My idea is—I do not know if worked out in figures how far it would suit—but my idea is that you might have two terms of enlistment. I would enlist men first of all for a sort of Militia service: two years at the depot, and ten years as the Militia now are, disembodied, but liable to be called upon for a certain period of training. Of course, men enlisting under that form of engagement would naturally receive a lower rate of pay, and perhaps no bounty; or, if any bounty, a lower rate of bounty than men who engage on terms similar to the present terms of engagement in the line regiments, namely, continuous military service for twelve years, taking their turn of colonial duties. Supposing such a thing were practicable, and you had a large body of men enlisted to serve on these terms, namely, serving at the depot for two years, and then returning to their homes as the Militia do, then I think it would be easy from this body of men to find volunteers sufficient to man the number of battalions, whatever that number might be, that was requisite from time to time to furnish troops for our colonial duties. I have thought of the question principally with reference to peace; I have not thought much of it with reference to war, because, as the gentleman who spoke lately said, you can only provide for that contingency by conscription. I think as he thinks, that for raising the vast number of men that would be required to contend with a first-rate power such as France, there is only one way of doing it, and that is, by conscription. My observations only apply to the peace services of the country. I think it is very desirable that those who have to look into these matters should consider the propositions of Major Leahy, and having worked them out in detail, should see what their advantages and disadvantages are. My idea is, that we should have three battalions, one for home service, one for colonial service, and one for the Army of Reserve; and I think that a battalion of Militia might be associated with them; that would make four altogether. That is the only point I have thought of; perhaps I should not have spoken at all if I had not found that the opinion I had arrived at, without having any communication with them, coincided with the opinion of gentlemen who I have no doubt have thought the subject out much more carefully.

Captain MONCRIEFF, Edinburgh Militia Artillery: I wish to make one or two remarks in connection with this very important subject, but I shall not venture to speak upon any point except the one which relates to the Militia. I have the honour to belong to that service; I have been in it for thirteen years, and am tolerably well acquainted with the Militia in England, Ireland, and Scotland, in which countries I have served. It has often occurred to me that those gentlemen who write and speak upon the subject, take a view of the Militia, which is the natural point of view, certainly, for regular soldiers and men who make arms their profession to

take of it. But I conceive my lord, that in any question relating to the organization of the Army, the Militia of England must always have a very important place; because our regular Army is a very small one in proportion to those of our neighbours. The new force of Volunteers is one, the action of which is as yet unknown; and really the only expansive force which this country has to fall back upon, is the old Militia force of the country. It has still the advantage of being a force which can be raised by ballot at any moment, and which, therefore, may be increased very largely when required. Some gentlemen who have already spoken have treated the subject as relating to times of peace; but I think the most important bearing of this subject is the one which relates to a time of war, when the utmost energies of the country must be put forth. It is in that case that the Militia will be called to aid the regular forces, and will become the real Reserve. In relation to this, I find, that in speaking of the Militia, it has always been considered as a feeder, that its principal function is supposed to be that of a feeder to the regular Army. No doubt that is a very important function. But I should like to place before this meeting another view of its importance. If the regular forces of England are sufficient to meet the necessities of a great war, by all means allow all our auxiliary forces to act merely as feeders; but if at any moment our whole regular Army were very much engaged and taken up, both abroad and at home, we must look to an organization at home which has some elements of self-reliance. I therefore think that in dealing with this subject, it might be kept in view that our militia should be so treated, that it would be able to act, not only with, but independently of the regular Army. The gentleman who spoke a short time ago said he believed, and a great many coincided with him in that belief, that the reserved forces ought to lean still more upon the Regulars in all their operations. So far I quite agree with that remark. I think they ought to be so trained and so organized, that they should always have the Regulars as their model and be able to act with them. But I do not think that they would be a less powerful support to the Regulars if their organization were of a character to develop its own resources. This leads me to the few suggestions which I should like to make with regard to the Militia, in order to make it a Service upon which the country might more fully rely than it does at present, and which would give it that self-respect and professional feeling which I am afraid is wanting in it to a great extent at the present time. As far as I can gather from the conversation of those who speak upon this subject, I find that, if the Militia perform their functions in barracks, march past well, make a nice appearance and look like Regulars, that is all that is required of them. Now, I conceive, in order to make our Militia useful to the country, and a force to be relied on, that the great object should be to have its Officers educated in such an efficient manner as that they shall feel themselves qualified, and shall be actually qualified, to take the new levies and train them, however largely they may be increased in numbers, and also to perform for themselves temporarily, those staff duties, which an organized Militia would require. I think the omission of this is the great flaw in our Militia training, as it at present exists. The question is, what is efficiency? If efficiency consists in collecting a certain number of men at the county head-quarters for one month in the year, and making by any means, and by the best means and the greatest exertions, those men look smart, drill well, and so on, I believe the Militia performs its duty very well. But at the same time, I believe the Militia would be a far more important auxiliary force if it received some organization which would make it consistent as a whole. For instance, if the country were divided into military districts, the head-quarters of each being supplied with a certain number of the regular staff of the Militia, and these head-quarters were kept during the whole of the drill season as a school for some Officers and men, I have no hesitation in saying that the Officers of the Militia would gladly avail themselves of the opportunity of learning their professional duties there. I have heard that the county gentlemen, who form the largest class in the Militia, would grudge the time, labour, and attention required to qualify themselves for their duties. But I think I may safely contradict that statement. I have always noticed that the best men in the Militia are those who are most ready to learn their profession. I should be sorry to think that the false position which the Militia officer is in at present, could be tasteful to any one. A force whose Officers do not get an opportunity of learning

their duty, is not in a fit state to take the field against an enemy. Unless every rank, especially the highest, is able to perform its proper function, I believe any attempt to make a first-rate Militia, will fail. Therefore I should like to suggest that greater opportunities may be given to Militia Officers to learn the duties which devolve upon them when they are called out. I am sorry that being unaccustomed to speaking I am not able to convey my ideas to this meeting as I should wish, but I think that my suggestions are worthy of notice; and, perhaps, some one will gather from my few remarks what I desire to say, and will be able to follow them up.

Mr. STIRLING LACON: I have read this paper of Major Edwards', and I have marked the number of times that the phrase, "in the event of invasion," occurs. I deny the possibility of an invasion, but as this paper and the discussion, like our *Journal* will be read by foreigners—let any one make a calculation of the extent of flotilla that would be necessary to bring over 30,000 men with their artillery and equipment. Moreover, directly the ships have let go their hawsers from the quays, the base of operations will be gone. I do hope, therefore, if this discussion is adjourned, that some Naval Officer will attend and tell us what they think of the possibility of an invasion.

Commander COLOMB, R.N.: Being the only Naval Officer present, though I have felt very strongly indeed upon the subject, when I listened to the remarks of Sir Harry Verney, yet I thought under the circumstances it would be clearly out of order to mention the wider question of the possibility of invasion, but as Mr. Lacon has adverted to that point, and called upon the Navy to speak for itself, I hope that I shall not be altogether out of order if I make one or two remarks touching upon that question of invasion. I have been surprised in reading Major Edwards' paper, and in listening to Major Leahy's, and the remarks which have followed during the discussion on these papers, to hear no reference whatever made to the belt of floating fortifications which surrounds the country. On the one hand I see the Continent of Europe, with—I am speaking off-hand—I suppose 100,000,000 or 150,000,000 of inhabitants, which might be leagued against England in the event of that floating belt of fortifications being destroyed. On the other hand, I see a little island, with 30,000,000 or 32,000,000 inhabitants, who are supposed, by an organization among themselves, to be able to resist these 150,000,000 of men which can be brought against them. I look upon it that the idea is simply absurd, viewed in that light, to suppose that you can, by an organization of the interior forces of England, resist such a power. Therefore, I feel strongly that when military men commence a discussion of this kind, they ought to take it at the commencement, upon a higher and a broader basis than it has been taken in the papers under discussion. The Defence Committee confined their attention exclusively to preventing the landing of an Army, and it seems to me that the organization of the Army of England, as far as resisting invasion goes, should also be confined exclusively to coast defence, where the arrangement of the troops in masses, with their proportions of artillery, infantry, and engineers, are out of place, as I take it. What you require to do in regulating the arrangement of the Army, as far as relates to the question of invasion, is simply this: we may suppose it possible that small bodies of troops may evade our floating guard, and make dashes upon certain points of the coast, and the means of concentration upon those points I take to be what is really the requirement of the Army, as far as it relates to resisting invasion. As to organization for the purpose of acting as an Army in the field, that, I think, can only be undertaken when we have settled that it is not only possible but probable that a foreign Army will land and act in the country. That is a possibility which it is simply a question of money to avoid altogether: you have simply to keep your floating fortifications up to a point which will prevent any large body crossing the channel, when you have done that, it seems to me that no further organization in England is necessary, and if you cannot do that, then, as I stated on commencing my remarks, we having four or five times, or more, population against us, and nothing to prevent them coming over in immense hordes upon the country, then I say your organization will not avail you in such a case.

Lieut-Col. Viscount RANELAGH: Sooner than that this discussion should flag, I should like to make a few remarks especially upon what has fallen from the gallant

officer who belongs to the Navy. I did not quite follow him; I did not quite understand whether he says as a naval man that an enemy can attack us from the other side of the Channel, whether it is France alone, or France and Prussia combined or not?

Captain COLOMB: No, certainly not.

Lord RANELAGH: Upon that point I differ from him. I think they can. In former years we know that to invade this country, the enemy were compelled to collect a very large force upon the opposite shores, whether it was at Boulogne, or Dunkirk, or Brest, at all events we were made thoroughly acquainted with their intentions, and we had a long time to prepare for them. I take it now that steam and railways have completely changed all this, and that we are living under different circumstances altogether. As far back as the year 1848, I wrote upon the subject, and I challenged the critics of the day by saying that you can invade this country from Paris. And I say, again, that it is much easier now than it was then. If we are obliged to have resort to other than wooden walls, I would ask the gallant Officer how with our present means we should be able to blockade every port on the opposite coast from Dunkirk down to Brest, and whether, with the intelligence that there is in France, and the powerful means of organization throughout their whole system, they could not by a combined movement come out of five or six of those ports at certain times? We cannot blockade all those ports at all times. Can you prevent those forces coming out? I say you cannot, and it would require great vigilance when they were once out, to know what their point of landing would be. Those are my impressions. There may be gentlemen present who will take up that point and say whether I am right or wrong. I again say that, if necessary, the basis of operations might now be Paris, not Boulogne, such are the facilities that railways give. With regard to the Militia, I am not come here prepared to go into the details of both these papers, for, unfortunately, I have only read one of them, but I have always had a strong feeling that every attention should be given to the strengthening of that great national force. I know no force that requires all our best wishes more than the Militia. Of course there are various notions abroad as to how to carry that out. I am not going into details to-night, but in some evidence that I had to give before the Commission some five or six years ago, I then adopted a plan, which I do not think I have any reason to find fault with or to change now. I was asked by the Committee what my notions of the Militia were. I said I would be glad to add my testimony to the estimation in which that force was held. Admitting for the moment that the permanent Militia ought to be 150,000—I believe it is now 130,000, but you might have 150,000 without any difficulty—I would put on the ballot. The word "ballot" is a very disagreeable word, a word that frightens most people, but I would not put on the ballot in the sense that most gentlemen imagine. I would ballot for a non-permanent Militia, for an extra battalion if you choose to call it so; I would ballot for another 150,000. By that means you would have an organization which is so much wanted in this country, so that in a moment of danger you would not be all abroad, all confusion, all hurry scurry. I would like to see the ballot put on in the different counties, the men told off, their names and residences taken down, and I would impose a penalty if any man went away from his county without giving his change of residence. For the first year or two I would not call them out, but there would be this great advantage, you would know where the men were, and would be able in forty-eight hours to call out that other 150,000 men. They would form a Reserve Militia. I would also say a word upon another force that I belong to, the Volunteers. It is not my intention to weigh the two forces, my sympathies go with the Militia. The Militia constitutes the back-bone, the sinews of England; but we should have this advantage with respect to the Volunteers, that the system of balloting I propose, would drive a large number of men into the Volunteers; the men who would not like to serve in the Militia, would go there. Then you would gain another great point, which perhaps you are not aware of, you would be likely to draw away many from the Volunteers who ought to be in the Militia. I believe that at the present moment you have in the Volunteers a large number of men who have no business to be there, who more properly belong to the Militia, and if they were not indirectly receiving money from the State, we should have them in this latter force.

This is a matter of great importance, because when the Volunteer force was first started, it was never supposed to be a paid force in any shape or way, therefore, I would throw it out for our next discussion whether, among other suggestions that have been made, that suggestion of having a system such as I propose might not be adopted. Connected as I am with the Volunteers, I will not enter on that question, but when we come to talk of the Militia and Volunteers, and of the 500,000 men entered on the estimates, or to talk of their organization, I must say that there is no such thing as an organization, it does not exist. If it came to a question of war, and we were suddenly called upon, we should not know what to do, there would be a perfect chaos; therefore, the sooner we put our house in order the better; and it is only by these discussions and talking these matters frankly over that we can improve. I come back, therefore, to the question of the Militia, whether you could not enforce the ballot upon the class of men who are not called out, and so form a second battalion. At all events you would have this great advantage, that you would know where to put your hand upon 100,000 or 150,000 men; and I am happy to say that such is the intelligence of Englishmen now, so superior is their education, that, instead of taking three or four months as they used to do to become anything like organized soldiers, a much shorter time would be sufficient. Very likely one or two months would make the men thoroughly efficient when once called out; besides this you have the regular Army. We must never lose sight of the fact, that the art of defence is very much changed now. A defensive Army, if organized, and not outflanked or out-maneuvred, has an immense advantage in the breech-loader. You have now in this country 200,000 or 300,000 men thoroughly efficient, and in proper positions, they would be equal to any emergency.

Captain COLOMB: I should like to say a few words with reference to the possibility of blockading our enemy's ports. The noble lord spoke of our present forces. I hardly dealt with our present forces; I dealt with what they would be in time of war; then, there would be no difficulty in blockading the whole of the ports. Blockade, now, since the advent of steam, is a very much easier thing than it was in the old war time. In the old war time it was necessary for a fleet to keep the sea, to keep under sail, because they dared not anchor; they dared not go into sheltered places for fear of a change of wind. All that has passed away. A very small force of steamers could blockade a port, and could not be driven away except by a superior naval force. We have seen instances of that in our own time. We blockaded in the Black Sea, and we blockaded in the Baltic; and the Americans blockaded the whole of the Southern ports with absolute ease. It would be the same with us.

Lieutenant-Colonel DYKE ACLAND, M.P., Devonshire Rifle Volunteers: I feel that an apology is due from me for rising to speak. I observe with very great regret that I have lost the opportunity of being here when the papers were read, and I am very glad to hear that another opportunity will probably be given for carrying on the discussion. I should not indeed venture on taking part in this discussion of the papers but for the remarks that have been made. I was very much struck by what Captain Moncrieff said, that he desired to see the Militia more self-reliant and more capable of action as a body by itself. But I was still more struck by what he said afterwards, as to the want of education and instruction for the Officers of the Militia. My purpose in rising is to put in the strongest possible manner I can, but calmly and quietly, my sense of the absolute necessity for something being done to educate our Volunteer Officers. I am not quite sure that I should carry the whole of the meeting with me if I were to say how that should be done. I have no doubt that military men who have faced danger, and have spent a whole life in military discipline, would not differ from me at all as to the fact that we want education. Undoubtedly we do. But I venture to say, I hope not disrespectfully, that I do not think that the education we want, is simply to be attached to the regular regiments as they are at present. I attached myself once to a regiment, hoping to learn something of the drill; and all that I learned for a good many hours was that the rear-rank man was to uncover by taking one pace to the rear with his left foot and so on. I heard it a hundred times, mixed with certain emphatic denunciations which were not in the drill-book. The thing that I wish to press on the attention of military men is,

the essential difference between the Militia and Volunteers and the Regulars, namely that the Regulars have plenty of time to learn their duties, and we have but little. And it is absolutely necessary, if we are to be taught, that the teaching should be put, not simply in a condensed form, but in an intelligible, rational form; not simply a tissue of directions out of books which we can read for ourselves at home. I do not, therefore, think that it is the most important point for Volunteer Officers that they should be attached to the regular forces to learn their drill, because I think if the adjutants and sergeants in the Volunteers are fitted for their places, which some of them are not, they ought to be able to teach that to their Officers at home. I hope the very distinguished persons at the head of the War Office, and the General who is now placed at the head of the Reserve Forces, will give their minds seriously to this question, whether we cannot have some sort of short staff course similar or analogous to the short musketry course at Hythe, which shall include for us theoretical instruction, not in things in general—not in the history of small arms and all those antiquarian subjects which are mixed up with others at Hythe—not in the history of warfare at a time which has gone past, as a matter of antiquarian interest, but simply and solely in this one practical question, what will you as country gentlemen, you as tradesmen, you as farmers, have to do if England is in serious danger of invasion. Now, I heard an expression fall from the noble Lord who has just spoken. I confess I thought he was a little hard upon Volunteers. I am sorry to say, with all due respect to him, having followed him in a review more than once, that I differ from the noble lord's opinion that what England now wants is a *corps d'armée* organized by Volunteers, and under Volunteer Commanding Officers. I think what we have to learn is, how to organize our own battalions, and how to put our battalions in the best possible position to be absorbed, and to be put under Generals of the regular Army. I think our attempt to form military trains and expensive military establishments is shooting very wide of the mark. You might do something in England, under good guidance, to organize our country people, our farmers, into some sort of transport corps. I think you would find country gentlemen and farmers willing to lend their horses and carts if they saw it was a real practical matter that the country wanted. But what we do not like is taking up time with mere show. I know we are supposed to be men of show, but it is not really true. I assure you that the amount of work that some of us have to do, to get together 3,000 men in a County, or the amount of work we have to cram into 24 hours, is something like three or four days into one. We are simply bent on work, simply on that. Now, we have no education, and we have nobody to teach us. We do not know how to set about serving out food; we do not know how to economize time in getting troops into railways or out of them. Some of us have our own views about it, but some of our views may be wrong. What we cannot stand, is pipe-clay and routine. It is a sort of system which may do very well in the barrack yard, but it does not fit us, simply because we have no time for it. It is really that—we have not time. Therefore, the mere copying of what goes on in the Army, excellent as it may be for the Army—it is something upon which I do not pretend to give the slightest opinion, because without experience no man can form a judgment about it—but what I do say is, that the simple "aping" of the regular Army is not the way to make good Volunteers. I have served in the Yeomanry for 30 years, and I have been under good Adjutants and under very good Colonels. I think in the Yeomanry we have a great deal too much in the way of copying the cavalry. We cannot be cavalry; we cannot have trained horses. Let our men be ever so good, our horses cannot be trained. Of course, the same remark applies to the Mounted Rifle Volunteers. I think that is a crucial instance of the mistake of copying the regular Army. Now, what I have to invite the Officers present to consider, especially the noble lord in the chair, and the Secretary of State for the War Department—what I do intreat them to consider is, whether they cannot give us the opportunity of going to Aldershot or Sandhurst for a week or fortnight; not simply to hear the professor at the latter place read out his lecture—he may do that with great effect to gentlemen who have twelve months before them—but that we may receive from able men lectures adapted to our wants, and that, then, we may be allowed to go out with a flying column, not to have a jolly week in the mess

but that we may be put under the authority of a talented, intelligent, active young staff Officer, who will really give his mind to one subject, namely, that of teaching us what we ought to know. These are the sort of suggestions I would make at present. There are a great many other things which are necessary to make the Volunteers a more useful body than they are at present. Perhaps, I may be allowed to make one remark upon another point. Something has been said about putting the Volunteers under Generals. I do not know whether gentlemen present have seen Captain Phipps's pamphlet on our sham Army. I venture to ask you to read it. He treats our country gentlemen with the most ineffable contempt; he calls us "puppets;" he considers we ought immediately to be sent to the right about, and replaced by gentlemen who have been in the Army. That may be the best thing; that I say nothing about. But I do think there is a great deal in Captain Phipps's pamphlet which deserves the attention of military men. I think he is quite wrong in the idea, which is the back-bone of his pamphlet, that all the Volunteers, Yeomanry, and Militia should be immediately placed under the General of Division. I say that with the most lively and the deepest gratitude to Major-General Hutchinson, Lord Templetown, and to Sir Augustus Spencer, who have been the three Generals whom it has been my pleasure to know. There are no Generals that I could speak of in warmer terms. They are placed under very great difficulties. Under the system of our double government for the Army, it is extremely difficult for them to give us the assistance which they would willingly give us. But these are details which I will not trouble you with. It would be extremely embarrassing for General Officers to be put over men who are not under their command. I think what must be done, is to put us in a position which will make our own work a little more practical, by giving us the benefit of instruction by these Staff Officers. What I wish to urge is this: I want a well-constructed staff, composed of energetic and intelligent Volunteers, and including gentlemen who have left the Army, and to whom it is not convenient, or who do not like, to take commissions in a particular corps. I think there are many young men about the country who have left the Army in a fit of idleness, or for other reasons not so agreeable to their parents, who might go through this volunteer staff course of which I speak; they might wear a Volunteer staff uniform, and be employed in the organization of our Volunteers. There are other considerations which I hope to publish in another form; and I hope I have not been intrusive in what I have said this evening.

The CHAIRMAN: Perhaps the meeting would now wish to adjourn this discussion to some future day to be fixed by the Council?

Major LEAHY: Before we adjourn, I should like, with reference to Major Edwards' paper, to explain to the meeting the reasons which have induced me to put forward for discussion, propositions having in view the same end, but differing in their character. The propositions in Major Edwards' paper, which we are invited to discuss are:—"1st. To concentrate the Army to a greater extent in the United Kingdom." My reasons for not adopting that proposition are as follows:—The question of military organization divides itself, as explained in my paper, into three heads, the first is political, and it appeared to me, that it did not come within my province to propose discussion on matters settled for reasons that military men may possibly not be cognisant of. The reasons which induce the Government to distribute our Army in the colonies and our possessions abroad, are not before the meeting; I do not, therefore, propose to disturb that distribution. With regard to our regular forces, they are of two kinds. First, those that are permanently enrolled; secondly, the reserves. A question now open for discussion and decision, is how to attach to the regular forces a certain number of reserves, which have been authorized by Parliament to be raised, to increase the regular regiments to their war complement. It appears to me that, if we attach to the regular forces already in the country, the reserves which are authorized to be raised as necessary for completing the war establishments, we should provide the nucleus of *corps d'armée*, without interfering with the distribution in the colonies. With regard to the next proposition:—"2. To divide it into *corps d'armée* of equal strength, and distribute it with reference to them." I do not propose to distribute the Army in *corps d'armée* of equal strength; because the defensive work which the various *corps*

would have to do, differs very much, according to the section of the country in which each is placed. For that reason, I propose the distribution by districts, indicated on the map before you, and in table No. IV.

I have laid out the military districts, so that the head-quarters of each *corps* should be placed in some centre convenient to railway communication, which, I think is one of the chief conditions to determine the distribution. For the southern line of coast, Aldershot, where a camp already exists, is a convenient situation; and the district has been mapped out with reference to those lines of railway, the South Western lines, that converge in or about Aldershot. The *corps* stationed here would have a very important function to perform. It would be charged with the defence of a long line of coast, its main function being to defend London. It would, in case of expected invasion, occupy the Surrey hills being ready to move on any part of the south coast. It so happens that there is within this district a large amount of existing barrack accommodation, which may be made available for quartering a large number of troops. I therefore propose that in this district the means should be provided for forming the largest army *corps* in the kingdom. The regular Infantry in that district would number about 15,000 men; and reserving a certain proportion for garrison duty, you would have, on permanent pay, a *corps d'armée* of about 12,500 infantry, about half a Prussian *corps*. The Reserves in that district, including the garrison Reserves, would be about 21,000 men. The *corps* would, consequently, have the means of doubling itself by calling in the mere regimental Reserves, without appealing to the Militia. During the summer training, the *corps* might have 25,000 infantry under arms. Calling out the Militia, those 25,000 men might be turned into 50,000. You would have, in this district, the means of forming an army *corps* of 50,000 infantry; which, with a due proportion of cavalry, artillery, engineers, train, &c., represents an aggregate number of between 75,000 and 80,000 men. The next section of the coast liable to attack, is that which extends from the Thames, at Gravesend, round to near Brighton. For the defence of that line of country, a smaller *corps* might probably suffice. I propose to place the head-quarters of that district at Chatham, so that with existing railway communication, the troops could be readily thrown on the coast. But if—in the improbable, I will not say impossible, event of an invasion—driven back, they would occupy the line of hills, which would be taken up for the defence of London. That *corps* would consist of about 25,000 infantry, making a total of about 40,000 men, for the defence of the south-east coast. Another point which is liable to the possible threat of an attack is the eastern coast, that of Essex particularly. Harwich is the harbour which it is supposed an enemy would look to for its basis of operations. I propose that the head-quarters of the *corps* acting on the east coast should be in London. Looking to the present distribution and to the existing barrack accommodation, we could have in that district a *corps* of about 25,000 infantry, representing about 40,000 men. We should thus have for the defence of London one *corps* of nearly 80,000 men, one of 40,000, and another of 40,000; that is a total of 160,000 men, including the proper proportion of cavalry and artillery. That is irrespective of Volunteers; it includes the regular forces, the regular Reserves, and the Militia. I next propose to map out the western district, with reference to the railways which converge on Bristol. One railway goes off to South Wales, and the fortress of Pembroke, and another goes off to Plymouth. Although there is no military establishment of any strength at Bristol, a convenient situation for a camp may be found somewhere near the spot marked. I propose to make that place the head-quarters of the district. There is a large number of Militia in the western counties, and a camp of instruction should be formed. I propose to concentrate the Militia of the Midland counties at Aldershot. In the northern district there is a large proportion of Militia, and it is proposed to form a camp in some convenient place on the plains of Yorkshire. The functions of the staff of that district would be principally directed to the training of the Militia forces; that *corps* would act as a reserve to the Army for the defence of London. These are my reasons for proposing a distribution of Army *corps*, based upon geographical circumstances and railway communication, and also with reference to the barrack accommodation and Militia in the districts. It appears to me that it is, for our national defence, a better distribution

than in corps of equal strength. With regard to the next point in Major Edwards' paper, "3. To organise the Militia and Yeomanry, so that they can readily join the regular *corps d'armée*," that proposition involves the breaking up of the county organization, which has existed for three centuries. This involves legislation, and an entire alteration of the Militia laws, and unless it can be shown that the existing organization is defective, it appears to me undesirable. I am strongly impressed with the opinion that what we have got to do is to expand and strengthen our existing Militia organization with such minor improvements as may be necessary, and many have been suggested by gentlemen who have spoken here. Colonel Alcock made an important suggestion with reference to the Militia which I think it would be well to bear in mind. It was, that the men who served their regular time in the Militia should pass into a Militia Reserve; just as men who had served a certain time in the regular Army, should pass into the Army Reserve. Colonel Alcock pointed out that many men could not afford 28 days for their regular training, and that these men should be placed in a Militia Reserve. It appears to me that that suggestion is one that could be readily carried out. According to present laws, there is power to increase the Militia force, consisting of 120,000 men to 180,000 men in case of war or invasion. Consequently, there are 60,000 men that might be properly organized out of men who had passed their full time in the Militia, and who might be trained at a different time of the year, or for a shorter time, by the present permanent staff. I think all the gentlemen who have spoken on the subject have advocated the strengthening of the Militia, and the importance of keeping it up as a distinct service, and not as a nursery for the regular Army; that the Army should find its own recruits, irrespective of the Militia. It appears to me that with the present inducements to military service there ought to be no difficulty in doing so. The Militia and Volunteers are for home defence; and in any project for organization, I do not think it desirable to put forward propositions by which they would be diverted from their primary object—the defence of the country. With regard to point 4, "To give to the Field Artillery an organization which will render it capable of rapid expansion," I fully agree in all that Major Edwards has said upon that subject. I hope some Artillery Officer will give some hints and details on the subject. The 5th proposition is, "To form dépôts for the establishment and instruction of a reserve of trained men for the different services." For the reasons I have before stated, I think all Reserves should be attached to their own arms of the service: militia reserves to the militia, line reserves to the line. I may state with reference to Captain Colomb's remarks, that my reason for not entering into the question of naval defence was, that I thought the paper already went into too many subjects, or I should not have left it untouched. I cannot coincide with all that Captain Colomb has laid before the meeting with reference to the impossibility of an enemy landing in this country. I fully appreciate, and have borne in mind the fact, that the naval forces must be our first line of defence. But I cannot bring myself to believe that all he says about the facility of blockade is practicable. In former wars our ships were independent of coal, but in these days of steam, armour-plated ships and ships of small size cannot remain out of port for any length of time without coal. With regard to Colonel Robertson's remarks, he will find that the suggestion of recruiting for two terms of enlistment is embodied in my paper; but I did not consider the question of the conditions of service was one which could be appropriately discussed, and, therefore, I did not propose to touch upon it. I do not know that there were any objections taken to my propositions, but I thought it right to explain why, having the same desire for organization in view, I propose different means of arriving at the ends that are proposed in Major Edwards' paper.

Major EDWARDS: I should like to make a few replies to several statements that have been made, and with regard to my paper in particular. General Boileau first of all spoke about the military train not being sufficient. The eight troops of military train, as laid down by the Committee, are merely taken as a starting point. I do not know whether that number is sufficient or not: I should say it is not one-third of what we should require for active service abroad. But in this country it would serve as an admirable nucleus for all that we should require. He also stated that a

military train—I mean of wheel-carriages would be of no use in India. Having served but a very short time in India, my opinion is of little value. But what I mean by attaching a military train to the *corps* in India has been explained by Colonel Ewart, that you would have a large body of non-commissioned officers and men from whom you could form trains of different descriptions as you might require them for different services. If Sir Robert Napier had ordered a division of one of my *corps d'armée* for service in Abyssinia, it would have had with it a portion of its military train; and when they landed on the coast of Abyssinia, they would have had officers and men who understood their business, who could have at once formed the Land Transport Corps into something like an organized system, instead of having to create it in time of war. I stated in my paper that the Native troops should supplement the European troops in certain tropical colonies. What I meant to say is, that that system which has existed for some years in China should be generally carried out; because Europeans are called upon to do all sorts of duties which destroy their health, and which can be done just as well by Natives. I think the European soldier is too valuable an article to be thrown away in that way.

Colonel Ewart recommended divisions instead of *corps d'armée*. I have given the name *corps d'armée* to this body of 16,000 men, because that is the name adopted by the Committee of Officers assembled to consider the equipment and supply of an army in the field. But it is really only a division of the Prussian army; and I have taken it as a nucleus, because when it is doubled it makes a *corps* of about as large a body of men as can be brought together for tactical purposes. Major Leahy recommends some *corps* of very considerable strength; but it was found in the late campaign in Bohemia that the Prussian *corps* of 32,000 men could better act by divisions of 16,000 men for tactical purposes. It has also been stated that we have now a large body of staff officers, who have been trained in the Staff College, and available for any duty. Unless some system is established by which these staff officers may know how to work,—unless they can know what their work is to be in time of war—I mean unless a system is established for them to act upon, I do not see how they can be of much use. Colonel Ewart also stated that the *corps* such as I propose was not suitable for Abyssinia. In my paper I recommended a *corps* organization for India; but I do not strictly adhere to that, because I do not so much care about the organization of the army in India; our great object should be to organize the Army in this country for the purpose of resisting invasion, and for sending an army on foreign service. I merely threw out this suggestion for the establishment of *corps* in India to fall in with the organization of the regular Army. But I still maintain that the establishment of *corps* in India would be of the greatest advantage. Does anybody know the number of portions of different *corps*, small bodies of men that are now serving with the Abyssinian expedition? There are, I do not know how many portions of different regiments of Native cavalry and infantry; whereas a division of one of my *corps* would have formed a body of 14,000 or 16,000 men accustomed in time of peace to act together; consequently, when they went on service, they would know their work very much better than they could do, if suddenly brought together for active service in the field. In a remote country like Abyssinia where they have not been called upon for actual service in the way of fighting, it does not so much matter. It has been suggested in Major Leahy's paper, that encampments should be formed. With that I entirely agree. And I have suggested in mine,—“the occasional exercising of our troops in camps.” The organization which I proposed for the Militia and Yeomanry, was with the view that they should at once join the regular *corps*, and go into camp for a short training. I entirely agree with what Captain Moncrieff has stated, and I think if he will do me the kindness to read my paper, he will see that most of his propositions are met in it. There seems to be an idea that the Militia should be organized on its own basis. But I think it must be organized with the view of joining the regular army, because it is impossible that it can act efficiently by itself; and the great object in organizing all our various forces is, that they should at once be able to form a regular Army. The system which I propose for the Militia, I threw out as a tempting bait in the hope that some distinguished

Officers in that service, who could enlighten us on the subject, would come forward and state how that object could best be gained. We have heard a great deal of hundreds of thousands of men, but all these men are of no earthly use, unless the different arms of the service are duly proportioned to each other. That is an opinion which I entertain most strongly. I mean this, that a thoroughly organized and equipped army of 80,000 men, with all its different services complete, is more than a match for 150,000 men without organization, the greater proportion of whom are infantry, with very few field artillery. Therefore, I would rather see the Militia reduced at present, so as to make the number, whatever it may be, perfectly efficient. The system which I proposed was the best that suggested itself to me at the time, and I very much wish that Officers who can give an opinion on the subject, will come forward and really assist us, because it is, perhaps, more a political than a military subject. There is one subject that Lord Ranelagh mentioned, that Volunteers should not be a paid force. That I think everybody will agree with. I believe the original intention of the Volunteer movement was, that it should train many of the able-bodied men of the country in the use of the rifle. In these days simply to know the use of the rifle is of very little use without a certain amount of drill to enable men to act together; they should therefore also be trained in their company and battalion drill. I entirely agree with Mr. Dyke Acland, that the Volunteer organization is essentially battalion, and that it would be almost impossible to attempt to give it an army organization. The battalion organization would place at the service of the State in time of need a great number of men who would be invaluable in the defence of the country. Perhaps, it may be exaggerating the mark, but I have always thought that for the garrisons of our different dockyards we should require 150,000 or 160,000 men. At least that number of men could be placed in those garrisons, and the greater mass of our Volunteers would find plenty of occupation in protecting our dockyards. The more efficient battalions might at once be brigaded with the infantry of the regular Army. Major Leahy has stated that he does not consider the various army *corps* should be of equal strength. I hold that it is the groundwork, and the principal basis of an efficient army organization; because if these *corps* are of a different varying strength, you can have no uniform system among your whole Army; and a *corps* of 65,000 or 70,000 men must be divided into smaller *corps* to make it of use for service in the field. I wish to see a system introduced in time of peace, which will enable the whole of the Militia of the country at once to fall into their places in time of war, because I do not imagine that anybody supposes, that if such an event as an invasion of this country did take place, any great amount of time would be given for preparation for it. We have also heard Captain Colomb make some remarks as to the possibility of invasion. This, however, is more a political than a military question. Being employed at present in the construction of some of the largest forts in the kingdom, with the view to protect a dockyard from an army landing in this country, I naturally come to the conclusion that the country may possibly be invaded.

The CHAIRMAN: If it is the wish of the meeting that the discussion should be adjourned, the Council have named the 11th of June* for the renewal of such observations as gentlemen may then wish to offer.

General BOILEAU: Before the meeting adjourns, I trust I may be permitted to offer our thanks to the noble Lord for his kindness in presiding over us this evening, and to request that he will again favour us with his presidency at the adjourned discussion.

The CHAIRMAN: I beg to return you my thanks, but I do so only temporarily, as we are to meet again.

* The discussion was not taken on that day, but was adjourned *sine die*.—ED.

The following memo. has been communicated by Major Leahy:—

"Sir C. E. Trevelyan, in pages 53, 54, and 64 of his pamphlet, entitled 'The British Army in 1868,' published subsequent to this discussion, adopts the views and calculations set forth in pages 17, 18, and 19 of my paper (see pages 326, 327, and 328), as printed for private circulation before its appearance in this Journal."—A. L.

OUR INFAN

Proposed Distribution of Battalions, Brigades

[illegible]

Brigades, and Divisions, in Great Britain and Ireland.

WESTERN DISTRICT. Head Quarters, Bristol.				NORTHERN DISTRICT. Head Quarters, Manchester.			IRELAND. Head Quarters, Dublin.		
No. N.-C. Officers and Men.	Brigade Head Quarters.	Battalion Head Quarters.	No. N.-C. Officers and Men.	Brigade Head Quarters.	Battalion Head Quarters.	No. N.-C. Officers and Men.	Brigade Head Quarters.	Battalion Head Quarters.	No. N.-C. Officers and Men.
1,064 1,064 532 532 532 1,596 532 532 1,596 532	Plymouth (1). Pembroke (1).	Devonport (3) .. Tregantes, &c. (1) .. Plymouth (1) .. Staddon, &c. (1) .. Bristol, &c. (1) .. Pembroke (2) .. Newport, &c. (1)	1,596 532 532 532 532 1,064 532	York (1). (Cavalry). Newcastle (1). Edinburgh (1).	Manchester (2).. Chester (1) Sheffield (1) Ashton and } Bury (1) .. } Preston (1) Fleetwood (1) .. Newcastle (1) .. Edinbro' (1) Glasgow (1) Aberdeen (1).... Fort George (1)	1,064 532 532 532 532 532 532 532 532 532 532	Dublin (1). Curragh (1). Belfast (1). Cork (1).	Dublin (2) Gds. Do. (4)..... Curragh (2) Kilkenny (1).... Athlone (1) Enniskillen (1).. Belfast (1)..... Templemore (1) . Cork (2)..... Kinsale (1)..... Waterford (1) .. Fermoy (2) Limerick (1)	1,064 2,128 532 532 532 1,064 1,064 532 532 1,064 532 532 532
8,512	2 Brigades.	10 Battalions.	5,320	3 Brigades.	12 Battalions.	6,384	5 Brigades.	20 Battalions.	10,640
	Camp. (To be selected.)	Royal Marines. 1226.		Camp. (To be selected.)	Royal Marines. Nil.		Camp. Curragh.	Royal Marines. 677.	
258	Fortresses.	Garrison Corps.		Fortresses.	Garrison Corps.		Fortresses.	Garrison Corps.	
258				Nil.	Nil.				
	Plymouth. Pembroke.	Plymouth (1) .. Pembroke (1) ..	258 258				Cork.	Dublin (1)..... Cork (2).....	258 516
9,028 11,186	Reserve Stores.	Reserves	5,836 7,940	Reserve Stores.	Reserves	7,872	Reserve Stores.	Reserves	11,614 14,090
20,214	Devonport.	Total ..	13,776	Chester. Edinburgh. Tynemouth.	Total ..	14,256	Dublin.	Total ..	25,704
		Militia.			Militia.			Militia.	
1,137 1,137 914 914 1,083 746 905 326	Barrack Accommodation. Officers 313 N.-C. O. & Married Men..... 441 Men 6,300 Horses, Troop 780	1 Devon..... 2 do. Cornwall Glamorgan..... Monmouth..... Cardigan (2).... Radnor Brecon Hereford 1 Somerset..... 2 do. 1 Gloucester.... 2 do.	1,083 1,083 1,316 877 815 326 134 315 587 1,054 1,054 1,083 1,076		N. Western Northern Scotland.....	3,744 21,237 8,337	Barrack Accommodation. Officers 1,859 N.-C. O. & Married Men..... 1,936 Men 34,222 Horses, Troop 6,187	Irish 28,759	
1,174 814 604 831									
10,585		13 Battalions ..	10,803		30 Battalions.	33,318		36 Battalions.	28,759
30,799		Total Infantry ..	24,579		Total Infantry ..	47,574		Total Infantry ..	54,468

APPENDIX.

OUR INFANTRY FORCES (BRITISH REGIMENTS).

TABLE I.

Proposed Establishments.

	Battalions.	Companies.	Colonel Commanding.	Lt.-Colonel Commanding.	Field Officers.	Company Officers.	Regimental Staff Officers.	Medical Officers.	Total Officers.	Proportion of Combatant Officers to Private Soldiers.	Staff Sergeants.	Company Sergeants.	Drummers.	Rank and File.	Total, all Ranks.	Reserves.
Company { Service India Home Depôts	1	1	1	1	1	3	3	3	3	1 to 33	4	2	100	109	20	Non-Commissioned Officers.
	1	1	1	1	1	3	3	3	3	1 to 33	4	2	79	88	62	Officers.
	1	1	1	1	1	3	3	3	3	1 to 33	4	2	58	67	184	Rank and File.
Battalion { War India Home Depôts	1	1	1	1	1	30	30	30	30	1 to 28	40	20	1000	1109	160	Non-Commissioned Officers.
	1	1	1	1	1	30	30	30	30	1 to 28	40	20	790	899	336	Officers.
	1	1	1	1	1	30	30	30	30	1 to 28	40	20	600	708	690	Rank and File.
Regimental Depôt. { Peace India Home Depôts	2	2	2	2	2	6	6	6	6	1 to 19	10	4	114	134	656	Non-Commissioned Officers.
	2	2	2	2	2	6	6	6	6	1 to 19	10	4	114	134	656	Officers.
	2	2	2	2	2	6	6	6	6	1 to 19	10	4	114	134	656	Rank and File.
Regiments India, (Service Companies, and Depôts) Ditto, War Footing	1	1	1	1	1	36	36	36	36	1 to 21	50	24	904	1033	656	Non-Commissioned Officers.
	1	1	1	1	1	36	36	36	36	1 to 21	50	24	1200	1329	320	Officers.
	1	1	1	1	1	36	36	36	36	1 to 21	50	24	1200	1329	320	Rank and File.
Brigade, Service, Ditto, (Home Ser- vice)	3	3	3	3	3	90	90	90	90	1 to 17	30	120	3000	3327	1280	Non-Commissioned Officers.
	3	3	3	3	3	90	90	90	90	1 to 17	30	120	3000	3327	1280	Officers.
	3	3	3	3	3	90	90	90	90	1 to 17	30	120	3000	3327	1280	Rank and File.

OUR INFANTRY FORCES—(BRITISH REGIMENTS).

TABLE II.

Proposed Distribution.

	Regiments.	Battalions.	Companies.	Officers (exclusive of General Officers).	Medical Officers.	Non-commissioned Officers.	Drummers.	Rank and File.	Total, all Ranks.	Total, all Ranks.	Reserves.
Foot Guards, Infantry of Line, and West Indies Depôts, Recruiting, Pensioners' Staff	3	7	70	210	17	331	122	5,960	5,960	5,475	3,360
	36	46	474	1,698	92	2,370	956	35,456	35,456	49,720	59,140
	15	15	190	762	..	1,134	380	10,890	13,166	4,050	\$10,680
Total Home	39	68	734	2,700	109	3,835	1,468	46,470	54,582	59,245	73,190
Colonial. Garrisons.											
	11	11	110	396	22	550	229	7,380	8,577	7,088	3,360
	44	44	44	158	9	215	88	2,830	3,300	3,179	..
Colonies. Australia and New Zealand, Cape Colonies, British North America, Ceylon and Straits Set-	4	4	30	108	6	150	60	1,980	2,304	1,392	1,008
	74	74	36	130	7	184	72	2,330	2,723	1,392	1,008
	15	15	150	540	30	750	312	9,760	11,392	9,948	15,976

Cape Colonies	36	130	7	184	72	2,330	2,723	Cape Colonies ..	3	24	90	6	126	48	1,392	1,662	11,008
British North America ..	15	150	30	750	312	9,760	11,392	North America {	16	128	480	32	672	256	7,424	9,948	15,376
Ceylon and Straits Settlements	2	20	6	100	40	1,420	1,638	Ceylon and Straits Settlement ...	2	16	60	6	84	32	1,400	1,582	..
Total British Establishments	111	1,164	4,248	204	5,984	23,490	27,755	Total	110	1,240	4,438	210	6,400	2,490	74,114	87,642	83,942
Indian Establishments ..	52	520	1,872	156	2,600	1,064	40,270	India	50	400	1,500	150	2,100	800	40,000	44,550	..
Total British Regiments ..	113	1,684	6,120	300	8,585	3,413	115,240	Total	110	1,640	5,938	360	8,500	3,290	114,114	132,192	83,942

* Includes 15 Depot Battalions. † Garrison Battalions. ‡ Local Reserves—Several batches of Reserves could be trained annually. § Infantry Pensioners.

TABLE III.

OUR INFANTRY FORCES.

Present Distribution.

Proposed Distribution.

	Battalions.	Companies.	Officers.	Non-Commissioned Officers and Men trained and organized.	Reserve, Partially trained, but not organized.	Totals (Approximate).		Battalions.	Companies.	Officers.	Non-Commissioned Officers and Men.	Reserves.	Totals (Approximate).
<i>Home Army.</i>													
Infantry Battalion, ...	53	544	2,047	39,369			Infantry Battalions ...	100	800	3,005	52,190		62,500
Depot Battalions, Pensioners, and Recruiting Staff	15	190	762	11,404			Garrison Battalions ...	15	60	180	3,870		10,690
Total Infantry	68	734	2,809	50,773	80,000		Militia Infantry	115	860	3,185	56,060		73,190
Army Reserve .....	..	..	..	..	116,170†		Volunteer Infantry	131	..	4,146	†116,170		..
Militia Infantry	131	..	4,146	..	167,056‡		Total Infantry Home .....	..	..	..	167,056		..
Volunteer Infantry ..	..	..	..	..	..	†422,000		..	..	..	..		†420,000
Total Home* .....	..	..	..	..	..	..		..	..	..	..		..
<i>Colonial Garrisons.</i>													
Infantry Battalions ..	20	200	762	15,016	..		Infantry Battalions ...	17	136	532	10,906		3,360
Local Corps	6	66	266	..	6,271		Garrison Battalions ...	11	44	240	2,838		..
Local Militia .....	..	..	..	..	6,000		Local Corps	6	66	266	6,271		..
Total Garrisons (about)	..	..	..	..	..	27,000	Local Militia (about) ..	..	..	..	..		30,000
<i>Colonies.</i>													
<i>British North America.</i>													
Infantry Battalions ..	15	150	570	10,822	..		Infantry Battalions ...	16	128	512	8,459		5,376
Local Corps	1	12	52	..	1,298		Garrison Battalions ...	4	16	52	1,032		2,760
Local Militia and Volunteers (about) .....	..	..	..	..	198,000		Local Corps	1	12	52	1,298		..
Ceylon, Straits Settlements, Cape, and Australia.	..	..	..	..	..	210,000	Local Militia and Volunteers (about) .....	..	..	..	..		198,000
<i>Cape and Australia.</i>													
Infantry Battalions ..	9	86	328	6,336	..		Infantry Battalions ...	8	64	258	4,312		2,352
Local Militia and Volunteers (about) .....	..	..	..	..	15,000		Local Militia and Volunteers (about) .....	..	..	..	..		15,000
<i>India.</i>													
Infantry Battalions ..	52	520	2,028	43,934	..		Infantry Battalions ...	50	400	1,650	42,900		..
Local Infantry (about)	..	..	1,366(1)	101,073	..		Local Infantry .....	..	..	(1) 1,366	101,073		150,000
			2,401(2)							(2) 2,401			
Total Infantry Forces						830,000	Total Infantry Forces ..						837,000

(1) European. (2) Native. * Trained Bands not included. † Power to add 60,000 in time of war. ‡ Enrolled, 145,752.

Evening Meeting.

Monday, May 4th, 1868.

REAR-ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B.,
Vice-President, in the Chair.

NAMES of MEMBERS who joined the Institution between the 27th April and
4th May, 1868.

LIFE.

Howes, Henry, Captain King's Own Light Infantry Militia. 9/.

ANNUAL.

Barnard, L. H. J., Ensign Rif. Brig. 1/.	Wright, A. F. B., Lieut. 9th Regt. 1/.
Scott, W. C. E., Capt. 3rd W. I. Regt.	Wilson, Chas. T., Capt. 4th K. O. 1/.
Glennie, Farquhar, Lieut. 9th Regt. 1/.	

THE "MACKAY" GUN AND PROJECTILES.

By the Inventor, JAMES MACKAY.

Read by Major-General BOILEAU, R.E., F.R.S.

WHEN the great question of guns and armour became so prominent before the country, I determined to ascertain whether there was not a principle by which hard, unexpansive, elongated, smooth, cylindrical projectiles could be fired on end from smooth-bore guns so as to strike the object aimed at, on end.

With that object in view, I purchased a smooth-bore Enfield gun; and after firing from it 1,600 rounds of steel shot of various forms, I discovered that a projectile for such a purpose must be so formed as to receive a preponderance of the explosive force upon its shorter lines or axis whilst in its passage from the gun, to encounter the resistance of the air upon its longer lines or axis; in other words, it must be so formed and balanced from the centre of its length as to retain its axis of its own accord during its passage along the line of fire.

On the 27th of January, 1863, I was permitted to fire at Shoeburyness three of these cast-iron projectiles of my make.

The gun used was an 113 cwt. 68-pounder cast-iron smooth-bore. It was placed at a distance of 200 yards from a section of the "Warrior iron-plated target."

I was only permitted to use 9 lb. charges of powder, and as one of my projectiles weighed 115 lbs., and the other 125 lbs., it only gave 1 lb. of powder to every $12\frac{3}{4}$ lbs. of shot for the 115-pounder, and 1 lb. to about 14 lbs. of shot for the 125-pounder. It must be admitted that this proportion of powder was very small.

These experiments were carried out under the direction of the President of the then Iron-plate Committee. There were also members of the Ordnance Select Committee present.

I received extracts of a report from the latter Committee, stating that the effect of my shot on the target was considerable, but it was not stated to what that effect was mainly due. I regretted that very much, being desirous of ascertaining the Committee's opinion as to the reason why, in my opinion, one of these elongated projectiles of mine fired with so low a charge did as much, and more, damage to the target than six sphericals fired from the same gun, at the same experiments, with double the charges allowed for my projectiles, viz., 18 lbs. of powder to a 68-pound shot, or $3\frac{1}{2}$ times greater in proportion.

I think the lesson taught by the work of these projectiles of mine was very striking, as showing the importance of a steady flight at that early stage of the inquiry, as the extra effect upon the target could not have been due to the small charge of 9 lbs. of powder.

I am aware that the windage on my shot was very little; but that made little or no difference in their striking power.

I allude to these experiments merely for the purpose of showing that (from the experience gained by my practice with the smooth-bore shoulder-arm) I did succeed in shooting hard, unexpansive, elongated, non-rotary projectiles on end at the first trial from the 68-pounder smooth-bore gun; and to state that a member of the Ordnance Select Committee informed me at the same time that they themselves had not succeeded in so doing.

Some persons have put forward claims without the information afforded by practical experiments, that spiraled, elongated projectiles can be practically and successfully rotated from smooth-bore guns, by the explosive charge operating upon the spiral grooves or bars formed on the surface of the projectile; but this method is impossible as a practical working operation in gunnery, unless the elongated projectiles be made on my principle, as already stated.

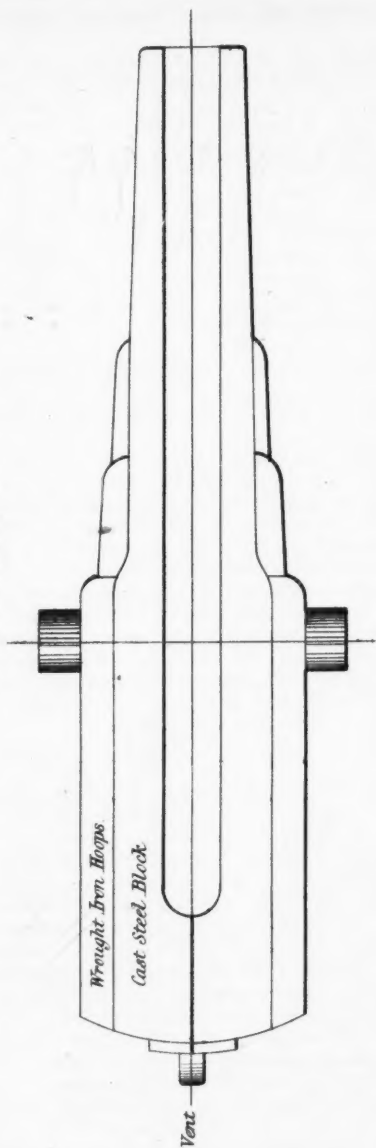
Other kinds of shot must fit the bore so accurately as not to allow any windage; and even then the rotation obtained is imperfect. One shot may hit middling fair by mere chance only; the next tumbles over, and so on. The reasons are, that the gun is the fixed body, the shot, the movable body. The gun having a smooth-bore, the resistance of the spiraled projectile is not sufficient to cause the longitudinal tendency of the explosion to be diverted into an even spiral course along the chase; besides, there are no means of centring the projectile in the gun during its passage to the muzzle.

The difficulty in procuring a perfect spin upon this method deter-

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SKETCH OF A "MACKAY WINDAGE GUN" FOR FIRING SMOOTH CYLINDRICAL ROTATING
PROJECTILES MADE OF HIS HARD METAL.

Scale $\frac{1}{4}$ in to a Foot.



NOTE.
Windage two Grooves
or more.



Patchcord or other Wad,
which may or may not be used.

NB. This system admits of
various modifications in
practice

mined me to groove the guns; and with this object in view, I purchased 12 smooth-bore Enfield guns, and grooved them for windage. This was the origin of what is now known as the "Mackay Windage Gun."

One of these windage guns had spiral grooves, with a twist of half a turn in the length of the barrel, which was 39 inches; in each of the others the twist was increased, the last of them having eight turns.

With these different guns I fired over 3,000 rounds of spherical and elongated hardened steel shot at iron and wooden targets, in comparison with other guns. My object was to acquire, through my practice with these shoulder-arms, the effect of the high windage spin to the shot, as a starting point, from which to construct heavy guns for the purpose of destroying iron armour.

Therefore, in speaking of the spiral grooves formed in the windage gun, it is necessary to dismiss from our minds altogether the word "*rifling*." The windage gun is not a rifled gun, in the understood sense of that word, as applied to guns.

I will endeavour to prove this.

In the rifled gun, the shot fits into and follows the grooves.

In the windage gun, the shot has no connection whatever with the grooves.

In the rifled gun, the rotation of the shot is fixed along the chase of the gun.

In the windage gun, the shot takes the mean of rotation due to its velocity.

In the rifled gun, the grooves are filled by the rifling on the shot.

In the windage gun, the grooves are left open for windage.

In the rifled gun, the shot must be adjusted to the grooves when being loaded.

In the windage gun, the shot requires no adjustment to the grooves.

In the rifled gun, the studs filling the grooves leave no room for the escape of air, when the shot is being rammed home.

In the windage gun the air escaping up the open grooves when the shot is being rammed home, admits of very rapid loading.

In the rifled gun, the shot being studded, rifled, or lead-coated, is subject to injury which may prevent its loading.

In the windage gun, the shot having no such attachments, may be roughly used, and yet not prevent their loading.

In the rifled gun, in order that the shot may load with a chance of certainty, it is necessary to allow the $\frac{8}{100}$ of an inch windage space between the body of the shot and the bore of the gun, to account for the chances of lateral deviations in the fittings, between the grooves in the gun, and the fittings on the shot.

In the windage gun the smooth shot rests on the lands, showing all the windage on its upper portion, requiring no allowance for deviations.

In the rifled gun the working windage, or the difference between

the diameter of the shot over the studs, and the bottom of the grooves in the gun is only the $\frac{5}{100}$ of an inch; thus, whilst the windage in the service rifled gun appears to be the $\frac{8}{100}$ of an inch, the actual working windage used is only the $\frac{5}{100}$ of an inch.

In the windage gun there is nothing on the shot to occasion the necessity of two diameters between the shot and the bore of the gun.

When the rifled gun is fired, the studs are forced through the grooves, resisting the natural longitudinal course of the explosive charge, they ride on the edge of the grooves, generating during their passage out of the gun a melting heat; this operation in rapid firing must draw the bore off the circle, and quickly render it unserviceable.

When the windage gun is fired, the front of the shot is resisted only by the air in the gun.

When the rifled gun is fired, the tendency of the explosive force is longitudinal.

When the windage gun is fired, the tendency of the explosive force is rotary.

These comparisons will serve to show the distinction between the two systems, and that the rifled gun is not a windage gun, nor the windage gun a rifled gun.

I allude particularly to these distinctions, because the use of long or round shot in the rifled gun has no analogy whatever to the use of long or round shot in the windage gun, even upon technical grounds, and in speaking of the operation of the projectiles fired from the two systems, the difference is still greater.

My experiments have proved satisfactorily that the proper shooting of hard, unexpansive, elongated, rotary projectiles is a very difficult matter; this, I think, has also been abundantly proved at Shoeburyness, if we examine the history of rifled experiments made there; there are so many obstacles in the very nature of the art itself to overcome and guard against.

1stly. The projectile should be cylindrical.

2ndly. The projectile should be delivered from the gun with its axis on a line with the axis of the bore.

3rdly. The rotation of the projectile should diminish equally, and in proportion to its onward flight along the line of fire.

4thly. The rotation of the rifled projectile, being a fixed rotation, the charge of powder in all cases should be nothing more in quantity and strength than sufficient to impart to the projectile the initial velocity due to its rotation.

5thly. It is questionable whether the proper mean of these two velocities, by which at every round even results are obtained on striking armour along the line of fire, can be practically procured upon the rifled projectile system as now in practice, paying regard to the safety and durability of the gun.

6thly. When the projectile is lead-coated, the force of the explosion packs the lead unevenly on its base, occasioning very weak shooting.

The facts are these, that elongated rotary projectiles have three

distinct motions during their flight from the gun, viz., the onward, the rotary, and the hobble motion.

This last motion is very difficult to rectify in rifled projectile guns, for, if not defined, the projectile will describe at each end two eccentric circles in the air during its passage along the line, each of these circles being more or less described, dependent upon many causes.

A projectile having this hobble motion when impinging on armour, does so obliquely, but it does not finish its blow in the same oblique direction. This sort of firing should, in my opinion, be termed hobble-firing, inasmuch as it is imparted to the projectile by a bad system of shooting.

Oblique firing, properly defined, is that in which the projectile strikes the target on a line corresponding with the elevation of the gun.

I have alluded to the practice with rifled projectile guns as at present constructed, for the purpose of comparison, and in order more clearly to indicate the course of my enquiry into the subject.

It seems evident that, with the difficulties enumerated in respect to the practical working of such guns in the hurry and bustle of actual war, a person following up the enquiry with a view to improvement would desire to obtain some method more suited to the rough and ready purposes required. I do not wish it to be understood by these observations that I condemn the rifled system altogether, but that I say that, if rifled guns and rifled projectiles must be used in the service to the exclusion of all other systems, great improvements can be made upon their present construction: I think, moreover, that my windage invention is an improvement on the present rifled system in many ways.

I have said that the body of elongated projectiles should be cylindrical, and made of one hard metal to retain their shape when the gun is fired; this accomplished, the next thing is to deliver them from the gun, with their line of axis on a line with the axis of the bore.

My windage system of guns accomplishes this object with a practical and serviceable amount of longitudinal windage between the shot and the lands of the gun. Should it be asked, "what I consider a practical amount of that windage to be," my answer would be, "That by which the windage system will defeat any other system of guns at present in use in rapid firing, before or after the projectiles for both systems have been subjected to very rough usage, each gun loading at the muzzle, other systems using the service windage."

I have also said that the velocity of the shot should diminish during its flight in proportion to its rotary velocity; this also the windage system accomplishes.

The shot having no hold upon the gun, the rotation diminishes towards the muzzle by the slip of the projectile; the grip of the explosion and wadding upon the projectile is less at the muzzle than at any other part of the bore.

My experiments have proved the overwhelming advantages of this sliding motion of the projectile, by which the gun is cleaned at every discharge, and by which it takes the mean of rotation due to its onward velocity.

If an increased charge be used, an increased grip is procured upon the projectile to correspond with the increased initial velocity due to the increased charge.

The invention of the "Mackay" gun is to meet practically the many obstacles by the use of shot which have no connection with the bore of the gun (as in smooth-bores), which shot having a sliding rotation seem to be from my practice more accurate and powerful than any others.

If this be so, it is not easy to overlook the cheap fabrication of the windage projectile, and the many other advantages of such a system.

Persons who are known to have much experience in artillery practice, have deemed that the windage gun does not rotate its shot, although my 3-inch muzzle-loading gun defeated the service breech-loading gun in June, 1865.

There seems to be a division of opinion on this point amongst artillerymen, as another admitted that the shot did rotate.

My opinion, as the inventor, of course, goes for little against such authorities, but such as it is I will state it, viz. :—

That no shot fired from any other system of guns possesses so perfect a spin; I call it "spin," because the word rotation does not seem to suit the motion of the windage shot.

In manufacturing operations, high spinning motions are obtained by straps or belts; the strap or belt is put over a pulley connecting it with a drum from a main shaft, and when the engine which drives the main shaft is set in motion, the pulley spins rapidly round; let us suppose that this pulley is the driving motion of a lathe, and that the workman is turning a shot, if the tool cuts so deep as to stop the spin of the lathe, the belt slips on the pulley, and the tool is preserved from breaking; just so is the operation of the windage gun.

The firing of the gun represents the starting of the engine; the operation of the belt upon the pulley represents the wadding and explosion surrounding the shot, by which the necessary spin is obtained.

On the other hand, suppose this spinning motion a rigid motion by cog and wheel, the operation would be, that either the tool or cogs would be broken, or a deep groove cut in the shot.

There are those also, who make objections without explanation; we will suppose one of these objections to be, that in the case of shot or other missiles breaking in the windage gun, or by the firing of grape or other compounds, the chase of the bore will thereby be cut away, and the gun become unserviceable.

These suppositions, advanced by practical artillerymen upon mere surmise, to those who know but little upon the subject, are decisive for the time being against an inventor, particularly when he is not permitted officially to prove its fallacy, however much he may have done so to his own satisfaction.

Let us see how much force there is in such an objection.

In the first place, the space between the front of the missile in the gun, and the muzzle is filled with air. If we compute the velocity of the explosive charge by the pressure of 180,000 lbs. more or less on every square inch of the base of the projectile, we ask the reason

why the projectile makes only 1,400 or 1,500 feet initial velocity per second from the gun?—this velocity cannot be what is due to such a pressure when the gun is fired; there must be some tremendous resistance to the expulsion of the projectile from the gun besides its own weight.

That resistance in the windage gun can only be the resistance of the air in front of the shot.

I have no means of computing the amount of that resistance, or the amount of pressure on the base of the shot, but in the windage gun, a preponderance of it along the chase of the bore rests in the grooves; the instant the charge is fired, the shot is forced into a whirlpool of air, gathering the missile to the centre of the bore, whilst the revolving explosive charge is the acting whirlpool of force on the base of the projectile.

Take for example, an eight-inch windage gun having a bore of 12 feet in length, and windage grooves of two complete turns in the length of the bore, the length of these grooves will be 4 feet longer than the axis of the bore; the explosive force along the chase of the gun has 16 feet to travel before arriving at the muzzle, whilst the axis of the shot has only 12 feet to travel.

The air along the chase of the bore in front of the projectile has also a proportionate tendency, so that keeping in view the great velocity of the charge on the chase of the bore over that of the axis of the projectile, very little reflection will serve to show that it would be simply impossible for broken pieces or compound missiles to injure the gun. I have contended, whether rightly or wrongly, that the windage system of gun has a greater striking power than any other.

If what I have just stated be true, a windage gun of 12 feet length of bore is more powerful than a smooth bore or rifled gun, having 16 feet length of bore, which has a column of 4 feet more air to expel from the gun, with a less density of force, in the proportion that 12 bears to 16. The great object in penetrating armour should be to apply the greatest possible force in the gun upon the base of the projectile, in order to procure the highest possible initial velocity. The gun which consumes or burns the largest charge of powder in the smallest space before the shot arrives at the muzzle, will certainly give the greatest velocity.

I have found that the windage gun will burn one-half more powder than any other gun, and this is very important, because, we can use a slow-burning powder, and at the same time procure the force of quick powder, which is destructive to the gun; besides, it is a very important matter to have as little smoke as possible in firing:—when the powder is consumed in the gun, the flame burns the smoke: this quality of my windage gun is well known at Shoeburyness.

I will sum up these arguments in favour of its power in this way,—that in consequence of the revolution of the explosive charge and cartridge wadding having a longer distance to travel along the chase of the bore, the powder is disturbed by this revolution, and completely consumed, thus densifying the force upon the projectile, whilst the longitudinal portion of the air in front is four feet less resistance to the

shot, besides, the weight of these four feet of metal taken from the muzzle, and added to the breech of the windage gun, would give a much more powerful gun of the same weight.

I will now allude to the formation of projectiles, which, I think should be so made as to allow the wadding and powder to surround them; this assists in keeping them level on a line with the bore when fixed.

During my practice, I tested numerous forms of elongated shot, but in all these tests, I have been led to one conclusion, viz., that elongated, rotary, projectiles should be semi-circular, or nearly so at both ends; the front semi-circle, for convenience sake, in some cases being drawn from a somewhat smaller radius similar to the model. My opinion is, that this formation of an elongated projectile is somewhere near a mathematical truth, because, in the first place, no shooting can be perfect unless the projectile is packed out at the muzzle of the gun by a sufficient quantity of unburnt powder or wadding.

In arms fired from the shoulder, the leaden projectile performs this office by expansion, and so in firing unexpansive shot, a substitute must be employed to cover the windage.

The formation of my elongated projectiles has been obtained after a long practice, by a most decided and marked superiority in their favour.

I have found them to proceed with greater steadiness through the air than any other rotary forms which I have tested. It seems to be a law that round ends and straight lines along the cylindrical surface of the projectile should be the true shape.

The modification which I have made by reducing about one-third the length, more or less, according to the total cylindrical length, is an improvement under some conditions.

There can be no question about the importance of having the centre of gravity in the centre of the projectile; this, to a degree, rectifies its hobble motion. There are two things to be considered on this point. The first is that the support of the air on the full-fronted shot tends to counterbalance the force of the explosion at the instant of the shot's departure from the muzzle. On the other hand, there seems to be little doubt that the reduced shot, once fairly delivered from the muzzle of the gun, produces a more even tone during its flight.

Again, the ricochet of these semi-circular projectiles is very good; they are not so liable to tumble over on striking the ground as square-bottomed projectiles, and their range is also good. As regards their front for penetrating armour, this is a question upon which much research has been made, but my experiments have led, I believe, to different conclusions on this point.

It seems to me undeniable, that the front of a projectile should be so formed as to cut a front hole in the armour of its own diameter, to prevent the side wedging of the armour upon it during its passage through.

It also seems to me undeniable that when an elongated projectile is hurled against armour it should be so formed as to cause every particle of its metal to support each other to save it from destruction;

in other words, to prevent the heavy bottom of the projectile from overpowering and breaking up the lighter front.

It may be thought that a sharp-pointed projectile will effect greater penetration, but I have found, as the results of numerous experiments, that it is much easier to force a block out of the plate of the shot's diameter than to wedge through it a long shot with a sharp point; but in saying this, in order that I may not be misunderstood on so important a point, I must explain that the windage gun spins its shot with an evenness, and at a speed unattainable upon any other system.

In this may lie the explanation of the excellence of the semi-circular fronted shot over others which I have tested, because, at the instant of impact, the semi-circular front, assisted by the high-spinning motion, draws the face of the plate impinged on towards its centre, thus cracking the iron around it, until the circle has fairly entered the armour. This much accomplished, the projectile is saved from destruction, inasmuch as the rolling of its cylindrical surface on the edge of the hole thus made, preserves it from breaking, and allows it to perform its work.

On the other hand, the sharp-pointed projectile, when fairly entered into the plate, breaks its point off, thus destroying its performance.

I am assuming, that these different forms of projectiles proceed fair to the armour upon their axis, free from any hobble motion, because the distinction is much greater in favour of the semi-circular projectiles under other circumstances.

If I am asked for further proof why I consider my projectiles of superior form to all others, I will advance the argument, that the windage gun imparts the two motions to the projectile by one and the same agency, viz., the explosive force. The consequences are, that the means of ascertaining the true principles on which a projectile should be formed, are at hand by the very nature of the system itself.

I will next show the working difference between the windage gun and the smooth-bore gun, which latter up to the successful experiments with my elongated projectiles; at Shoeburyness, on the 27th of January, 1863, has been used only as a round-shot gun.

There can be no doubt that the smooth-bore gun, with heavy charges of powder, throws round shot with considerable smashing power at short ranges; but the great drawback is, that it neither centres or spins its shot, consequently the ball rolls when the charge is fired, grazing the bore from side to side, and, on leaving the muzzle, continues to roll in its passage through the air, in a position corresponding to its last graze in the gun,—the effect of this rolling is very detrimental to its velocity and accuracy, and particularly so to its penetrative power, inasmuch as the inclination of its force, to a great degree, may be said to be lateral, vertical, or edgeways on the armour, producing a kind of oval indent.

One of the first conditions in penetration is to project the shot, whether elongated or spherical, in the best manner to save it from destruction.

A gun failing to meet this requirement, however good it otherwise may be, is not a proper tool with which to fight iron-clads.

The smooth-bore sadly fails on this point, when the plate is of the thickness of the shot's diameter.

Much has been said and written about the resistance of armour, increasing as the square of its thickness increases, but I hardly think it will be asserted that a 6-inch ball, fired at a 6-inch plate, will perform as much upon it as an 8-inch ball at an 8-inch plate, both shot proceeding at the same velocity.

I have found that the windage balls break through all these calculations.

The real truth is, that my experiments have proved that nothing but the very high, steady spin of the windage shot will enable it to perform the work due to its fabrication and the charge of powder used, and give that starting point, from which these calculations can be made.

I will re-state the meaning of this paper, and the conclusions to which I have arrived, by alluding to the armament of our Navy.

Every artilleryman is aware, that the ricochet of elongated projectiles upon the water is not to be compared to the ricochet of round shot; therefore, the conclusions are, that for sea-fighting, the elongated shot is inferior to the round shot, because, if the artilleryman misses the enemy, long shot will do little after grazing; whilst a round shot grazing in front of a ship, may prove very destructive: moreover the chances of hitting the enemy are in favour of the round shot in a sea-way. I am of opinion then, that guns on my system will prove the most powerful armament for iron-clads yet produced, since, in addition to their powerful shooting of elongated projectiles, their shooting of round shot is unparalleled in excellence to those fired on any other system.

A round shot from the smooth-bore plunges in the water, whilst a round shot fired from the windage gun has a much flatter trajectory, and skips along the surface.

I do not consider it necessary to support this writing* by referring at length to the numerous experiments which I have carried out with the windage guns, as many of them have been fully and accurately reported in the public press from time to time, and have been witnessed by officials and artillerymen of high standing; but it appears necessary, in order to show that the windage guns have perfect accuracy, to say, that my 12-pounder worked under official orders, at Shoeburyness, hit a target 9 feet square, distant 1,000 yards, 12 times out of 15 shots fired, and with projectiles and cartridges exactly similar; it made for rapid firing loading at the muzzle, 25 rounds in 6 minutes 25 seconds.

Although this practice may be considered good, I have, on the Crosby Sands, fired 21 consecutive rounds at a target 9 feet square, distant 500 yards, and placed every shot in the bull's eye, or in a circle of 18 inches, therefore, I do not think that any one can dispute the perfect accuracy of the windage gun.

As regards penetration, my 6-inch gun, with long shot weighing 82 lbs., with 22 lb. charges, penetrated a 6-inch plate with the greatest ease, at 75 yards from the muzzle, and buried the shot 7 feet in the sand beyond.

This same gun, with a 25 lb. charge, penetrated the "Agincourt iron-plated target, and the projectile carried away the backing, and passed many hundred yards beyond.

Again, this gun was fired at an 8-inch plate; the projectile buried itself in the plate, which was thrown over by the impact of the shot; and I have the authority of Major Klercker, who was present, to say, that if the plate had not given way, penetration would have been complete. This same gun at 18 degrees of elevation, with 12 lb. charges, throws its shot about 600 yards.

The 8-inch windage gun, with spherical shot, and 14 lb. charges, penetrates through a 5-inch plate at 75 yards, and the shot proceeds 1,000 yards beyond. The same gun with 30 lbs. of powder, penetrates through a 6-inch plate, and 780 yards beyond.

Some of these experiments were carried out in presence of members of the Ordnance Select Committee.

With the exception of the shot at the 8-inch plate, none of these experiments showed the full destructive power of the windage gun.

I may also add, that in 1864, the 8-inch gun with five elongated projectiles, fired with 30 lb. charges of powder at the "Agincourt target," distant 200 yards, penetrated through at every shot, driving from the target $1\frac{1}{4}$ tons of iron and backing.

I will just advert to windage breech-loading guns, to ask, what system could be more desirable for such a purpose?

I have understood that breech-loaders are to be discontinued in the Service, but looking at the advantages of breech-loading shoulder arms, it is a question whether it is a prudent course to condemn breech-loading artillery without further inquiry.

I have constructed a 12-pounder breech-loader windage gun, with which I have discharged 8 rounds in a minute, and which could be used in an instant as a muzzle-loader.

Mr. MACKAY gave the following additional explanation regarding the formation of his elongated smooth-bore projectile, which is made as follows:—A cylindrical bolt cut flat at each end in the proportion that 11 inches long bears to 9 inches diameter is reduced at one end to a semi-circle, the other end is cupped out similar to the model, sufficient to cause it to balance from the centre of its length when finished. An elongated projectile of this form proceeds on end at a high initial velocity from the smooth-bore gun, and is the most powerful missile used from smooth-bores at short ranges; this system, however, has one drawback, which is that the smooth-bore gun does not impart rotation to the projectile. I have found that a projectile proceeding at 1,800 feet initial velocity without rotation is not so powerful against armour as one with 1,600 feet initial velocity, and 200 feet of rotation. If velocity of rotation is imparted to the projectile, the initial velocity is reduced in exact proportion. A projectile proceeding at 1,800 feet initial velocity from the gun will destroy itself upon the target, whilst one with 1,600 feet initial velocity and 200 feet of rotation will pass through it. This shot (pointing to one on the table) at the first moment of impact thickened an inch more than its present diameter at the front, its high spin in passing through the plate rolled it together in its present form; there is no steel shot in the same state of preservation fired from any other system of guns through a plate of its own diameter.

Commander DAWSON, R.N.: Will you be good enough to explain what causes the spin of your shot? I do not quite understand the reason of it.

Mr. MACKAY: The reason of the spin in the first place, is the resistance of the

air in the gun in front of the projectile, together with the revolving explosive charge at its base when the powder is ignited. If you enquire why the projectile does not proceed from the gun at the velocity of the gases, I answer, that less the velocity at which the projectile proceeds, including its gravity, the resistance in front is equal to the pressure of the explosive charge at its base. I have seen this pressure stated in the "Mechanics' Magazine" to be 180,000 lbs. to the square inch. What happens is this, that the greatest force or pressure when the explosion takes place is first on the breech, next on the cross section of the bore, so that with a judicious preponderance of space in the grooves, it would be impossible to divert the gases along the chase from a rotary to a longitudinal course, the current, therefore, takes the grooves as perfectly as the tool which cut them.

Commander DAWSON: What causes the shot to rotate? Do you mean that the grooves cause it to rotate?

Mr. MACKAY: The grooves cause the rotation.

Commander DAWSON: By the intervention of the wad?

Mr. MACKAY: The wad would not cause the rotation without the explosive force.

Commander DAWSON: Is the rotation caused by the wad being driven up into the grooves?

Mr. MACKAY: I put the wad there as a substitute for powder. I put sawdust here (pointing to the part). Powder is made of chemical ingredients which will scour the chase of the bore. I prefer using sawdust there, because it is smooth and lubricates the gun, and allows the projectile to roll in its midst, by which rolling it takes the mean of rotation due to its initial velocity.

The CHAIRMAN: Your wad does the work that the studs would do in a rifled gun. We do not quite understand what it is that makes the shot rotate, is it your wad being squeezed into the grooves?

Mr. MACKAY: Not at all. It is the revolution of the charge, which I will proceed to explain. I spoke about the cross section force being greater than the longitudinal force; the cross section force is greater than the longitudinal force, the consequence is that the whole charge revolves, communicating its revolution to the shot, the gases running along, force the sawdust up in its front, which is more suitable for the purpose than powder, and less destructive to the gun; by these means rotation is obtained. Then you get rotation in another way. I said there was a pressure of air in front. This shot, if it was not for the air, would come out of the gun as quickly as the gases, less its own gravity and velocity.

Commander DAWSON: It appears to me that the same effect would take place in any gun if the conditions you have explained are correct. What I do not understand from your explanation is this: What is the peculiarity in your gun that causes the shot to spin?

Mr. MACKAY: The pitch of the grooves, and the manner in which the grooves are put into the gun, the preponderance of force—the explosion is made rotary instead of longitudinal.

Admiral ASTLEY COOPER KEY, C.B.: I should like to ask you a question. Have you ever tried to fire that form of shot without a wad?

Mr. MACKAY: Yes, I have. I can fire them as well without, as with; but it requires a different modification. The sawdust is merely put there as an improvement upon the extra charge of powder which does not consume. I have said in the paper just read, that no shooting can be perfect unless the projectile is packed out at the muzzle of the gun. You must not allow the gases to get in front during its passage out to the muzzle. I substitute sawdust for powder to prevent this.

Admiral KEY: I cannot help thinking that that quantity of sawdust between the powder and the shot must stop the gases passing over the shot. If you apply a paper wad to any shot without studs in our service guns, you nearly stop the whole of the gas from passing over the shot. Yet you can get with three grooves a certain amount of rotation.

Mr. MACKAY: Yet it would not strike with half the force of this shot.

Admiral KEY: Because there are only three grooves, and there is only a certain amount of rotation. But I agree with you it is a great advantage, if we

can succeed in firing shots from our guns without studs—there is no question of that. Still all the advantages are not on one side. You cannot attain the advantage you offer, without at the same time losing certain qualities that our service guns now have. In the first place, the great difficulty in regard to the endurance of our service guns is the being compelled to carry the grooving down to the powder chamber. By placing the studs very far forward, the grooving of the gun need only be carried down as far as the studs of the shot, as it lies in the bore. But in your system you are compelled to carry the grooves right into the powder-chamber. That is the weakest part of the gun; and that is the point where we find all the guns fail—in the powder-chamber itself. Certainly, even if you have all the advantages you claim, you would require to modify that point considerably in guns for the Service, on account of the weakness of the powder-chamber. I would also say that although the account you have given of the accuracy of the gun is very satisfactory, I have never heard it before,—striking, I think you said, twelve times out of fifteen, a target 9 feet square, at 1,000 yards, with a 12-pounder; in your gun you had very reduced windage, which could not be had in the service gun. I doubt whether with that system of rifling, it would be possible to get the accuracy that we must have in the service gun; and for this reason: The wad compressed against and passing the shot gives rotation to the shot, and that holds the shot at the base only, therefore the body of the shot and the point of the shot must have this "wabbling" motion which you complain of so much in the practice from our service guns. It must have this "wabbling" motion, if it is only held at the base. And as it leaves the muzzle, it must have a tendency to drop. I doubt whether you can ever get sufficient accuracy with large guns, if you allow the windage that we must have in our service guns. I would also say with regard to the penetration of the shot, that all your trials, as far as I have seen them, or as far as we have heard of them, have been against unbacked plates. There is no doubt that the hemispherical head or the flat head is nearly as good against unbacked plates as pointed shot; but when you come to fire against backed plates, or a ship's side, the advantages of the pointed shot are very remarkable. I do not think there is any question about that. The pointed shot have a great superiority in penetration. I would also say a word with regard to the penetrating power that you claim for your gun. I think the 6-inch gun,* weighing 9 tons, penetrated a 6-inch plate at 75 yards, a 6½-ton Woolwich gun penetrates a 7-inch plate, that is an inch thicker, at the same range with 15 lbs. of powder,—which is only two-thirds of its full charge.

Mr. MACKAY: A 9-inch bore.

Admiral KEY: A 7-inch bore. That 6½-ton gun will penetrate a 7-inch plate at 70 yards. I acknowledge the great advantage that we shall gain, if we can do away with the studs from our shot. Still there are several points that you will have to clear up before you can be satisfied that it will be introduced into our Service. One great point is, that objection to carrying the grooves into the powder chamber.

Admiral RYDER: Will you tell us presently whether you have fired any of your guns to destruction?

Mr. MACKAY: No. I have here a cast of a gun which fired 1,380 rounds.

Captain BURGESS: With what charge?

Mr. MACKAY: There were a variety of charges, some 4 lb. charges, some 3½ lbs., some 3 lbs., but generally 2 lb. charges.

Captain BURGESS: What weight of shot?

Mr. MACKAY: 12-pounder shot. Talking about windage in the service gun there is only $\frac{1}{100}$ ths of an inch between the bottom of the grooves in the bore, and the diameter over the studs in the shot whilst there is the $\frac{1}{10}$ ths of an inch difference between the body of the shot and the bore of the gun. My smooth shot must be

* Admiral Key has overlooked the fact that my 6-inch gun penetrated through the "Agincourt" iron-plated target, a fac-simile of the ship, range 75 yards, charge 22 lbs., weight of shot 82 lbs.—J. M., 30th July, 1868.

more practical with $\frac{1}{100}$ ths of an inch longitudinal windage, than the studded shot with $\frac{1}{100}$ ths of an inch of working windage on the studs.

Admiral KEY: The reason why we are compelled to give a certain amount of windage over the body of the shot, on board ship especially, is because paint, dirt, and rough things of that sort stick on the body of the shot, and we cannot do with less than $\frac{1}{100}$ ths or $\frac{1}{80}$ ths of an inch windage on that account. It is not so much on account of the stud.

Mr. MACKAY: The effect of the service system of windage is to raise the shot $\frac{1}{100}$ ths of an inch off the bottom of the bore, so that, in point of fact, the working windage space is only $\frac{1}{100}$ ths of an inch. My smooth-bore projectile would be more serviceable, more practical without a doubt; my shot, as I explained in the paper, rests in the grooves, showing the windage on its upper portion. I am convinced when paying regard to the requirements of the times, the advancement in science, and the safety of the artilleryman, that it would be found impossible to continue these two diameters in the service gun in actual practice. With regard to the grooves in my system passing down to the breech of the gun, which may or may not be the case, instead, in my opinion, of being detrimental to its strength, I think it far otherwise. I will endeavour to explain my reasons. If a workman is driving a bolt into the keelson of a ship, he requires to be particularly careful to strike the bolt fair on end; it requires the most skilled workman to perform this; if, in striking the bolt unfairly, the hammer trips and the bolt is not moved, I compare this operation to that of the explosive gases on the chase of the bore, because when the charge is ignited, the gases running up those quick grooves roll the force upon every angle of the metal, thus preventing that straight blow which is given in the smooth-bore and rifled guns. I am convinced that with two 68-pounders of the same metal, the one grooved on my system, and the other left smooth-bore, it would be found that the grooved gun would discharge many more rounds than the smooth-bore without injury. In the service rifled gun where the preponderance of force is longitudinal, the gases running onwards, cut the grooves; you can see how perfect my model is after firing 1,300 rounds of shot. I do not think that firing has altered the position of those grooves the slightest particle.

Admiral KEY: With what charge were they fired?

Mr. MACKAY: I fired a great many 4lb., 3lb., 2lb. 10oz., and 2lb.; sometimes 1½lb. charges. This is the muzzle taken off, after firing 1,100 rounds.

Admiral RYDER: Is the gun in existence now?

Mr. MACKAY: Oh, yes. Now here is a shot for a smooth-bore gun, there is not a ship afloat or a ship that can be built that will stand it for an instant. There is no ship that you can build that it would not smash.

Major-General BOLLEAU: Before this discussion closes I wish to address a few words to you on the subject. It is a very interesting paper which it has been my great privilege and pleasure to read. I am sure it must be very disheartening to an inventor whose first experiments were tried more than five years ago to know that five years' progress has only brought him to the reading of a paper before the United Service Institution. Setting aside various points of detail which Mr. Mackay has referred to in his paper, and which do not appear to me to require notice in discussion, the principle of the gun certainly has something in it very attractive as well as very novel. That there must be a great rotary effect produced upon the shot by the action of the powder in the grooves, I believe has been convincingly proved by the experiments which were conducted on Crossley Sands: although they were against plates not backed, still they were against plates of considerable thickness, and the effect of the shot was to penetrate in almost every instance. There is a report of them in the "Mechanics' Magazine" of October, 1867, which contained pretty much the same results as have been described in the paper. With regard to the shape of the shot, of course it will be presumption on my part, or indeed on the part of any mere reader of artillery experiments, to offer an opinion in opposition to what has fallen from the gallant Officer who has informed us of the relative advantages of hemispherical heavy shot and pointed heavy shot. There has been a controversy on this point for many years. Mr. Whitworth considers that flat-headed are the proper kind of shot for penetrating armour plating, and his steel shot had flat heads.

Major Palliser has adopted the ogival-headed shot, and the success of that has been very great. But I think Major Palliser told us here, and we have some shot in the Museum which to a certain extent corroborate what Mr. Mackay has said, that whether it is the vibration of the shot, or whether it is the length of the cylindrical portion of it, the body of the shot in many cases broke, so there is in that something in what Mr. Mackay has observed. But as regards the paper that has been read this evening, I consider it more in respect of the principle which Mr. Mackay advocates, that is the rotating of the shot by the movement of the exploding gas along the grooves, and giving the shot rotation. By that means he does away with the studs, and it is this which makes his paper interesting, and renders it worthy of study. I do hope that among the inventions which have been brought forward, and which have failed to produce appreciation in the mind of those who have to manage these affairs, Mr. Mackay may have a chance of further experiments, and that his gun may be either worked to death, or proved that it is capable of resisting the modern trials to which guns are now subjected by the Committee of which General Lefroy is Chairman. As a mechanician there is something very winning to me in Mr. Mackay's system. Of course, until it has stood the test of experiment, the question is simply a question of opinion. But I think it has certainly passed out of the category of opinion, and has become a matter of fact, and that it will receive further experiments, which will either confirm the views of the lecturer, or make it a thing of the past like many other inventions that have been brought before us.

The CHAIRMAN: We shall be all ready to give our thanks to Mr. Mackay for the paper he has brought before us. I am sorry it has not been so fully discussed, as I have heard the subject of guns discussed in this theatre; and I trust, that if experiments are wanting, those who have charge of these trials will give Mr. Mackay a chance of trying this gun. He has certainly one element of success: that is, he has the greatest possible confidence in it. I trust that, for his sake, his confidence will not be misplaced. We are delighted always to find members discussing these matters. I think it is doubly important that officers, who, from their official position, and from the long experience they have had of all the recent experiments, as my friend Admiral Cooper Key has had, are qualified to give opinions, should come here and assist us in our discussions, and place before us facts and statements that really have weight, and must carry serious conviction to those who are interested in these subjects. I think it is of vital importance to this Institution that men in the Admiralty, and who really have the opportunity of knowing what has been done, and is being done in these matters, should come here and tell us all they know about them, as far as their official positions will allow them to do so.

I will now call upon Captain Colomb and Captain Bolton to exhibit their new signal lights.

SIGNAL LIGHTS OF CAPTAINS COLOMB AND BOLTON.

By Commander P. H. COLOMB, R.N.

Commander COLOMB: I consider myself fortunate in having had a shorter paper and a shorter discussion than usual to precede me. It is a matter of congratulation to me, though I think it is hardly so to the subject which has just been discussed. To-night I purpose showing you some of the latest developments of the "flashing signal" system. That system is now pretty well known. It was first made public in this Institution, and I then stated, and it is quite proper that I should again state it, that like most other inventions it was not, when it came into Captain Bolton's and my hands, entirely original. That is to say, other gentlemen before us had hit upon the germs of the system, although it had never been carried into practice until we took it up, and probably never

would have been. Thus Mr. Goldsworth Gurney had the idea floating in his mind as far back as 1832. Mr. Babbage, about 12 years ago, carried out a great many experiments with flashing signals, and really did understand the question—understood what was really wanted; and had he been in a position to have carried it out, would probably have succeeded in it, as we have since done. As regards the lights which I am going to show you to-night, we have them in two or three forms, for different purposes. I wish to describe to you in as few words as I can the history of the light; how it came to be devised. A short time ago there was exhibited in this Institution a light, which is known by the name of the "Spakowski light;" that light was known to me in process of invention before it came to England. It was the invention of a Russian Officer; and it was suggested to me that I should stop some experiments that I was carrying out on something the same principle, because that Russian Officer was himself at work upon the point. I sent him a message to say that I would cease, and I did cease, on the understanding, as I thought, that when he had completed the light, he would communicate further with me upon the subject. However, he did not, and the first I saw of the light afterwards, was its exhibition in England. I saw it once before it was exhibited in this Institution, and I may say that I felt, and Captain Bolton felt, somewhat dispirited with regard to that light, and for two reasons, firstly, because the light was not our own light, and I believe, generally speaking, people are not very fond of things not their own that come across their path; and secondly, and principally, I believe, because we were afraid that, if a light connected with more or less apparatus came into the hands of any person who did not thoroughly understand the question of signals, the system we had built up with so much care, and, I may say, carried out with so much anxiety in its early days, might be destroyed by the ignorance of those into whose hands it might ultimately fall; for although the system has been now working between seven and eight years, it is not still quite on a satisfactory basis, that is to say it is still comparatively new, and people are not quite certain as to the little points of detail with which it is to be carried out. We often find people supposing that things can be done with it which cannot be done; and we were afraid that if by means of a new light, the system were taken out of our hands, it would ultimately fall through. We had therefore to set ourselves to work to devise a light which should simply beat it. We had, of course, to carry out a great many experiments with various other lights, the electric light, the lime light, the oxy-calcium light. None of these lights, however, satisfied us. The lime light was found by Captain Bolton to be the best for distant signals; there is no light that comes up to it for range, no light so practicable for extreme ranges. We had no choice as we stood, between the lime light, which has an extreme range of 20 miles, and the oil light, which has only a range of 6 miles in clear weather. We wanted some light, which should be between the two, which should give us a good light, equal to 12 or 15 miles on occasion, but which might not be so generally used at such long ranges, but would be more often, should the state of the atmosphere be such as to make pene-

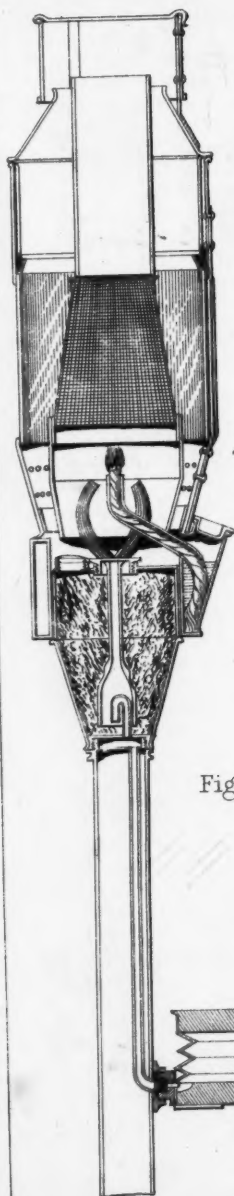


Fig. 1.

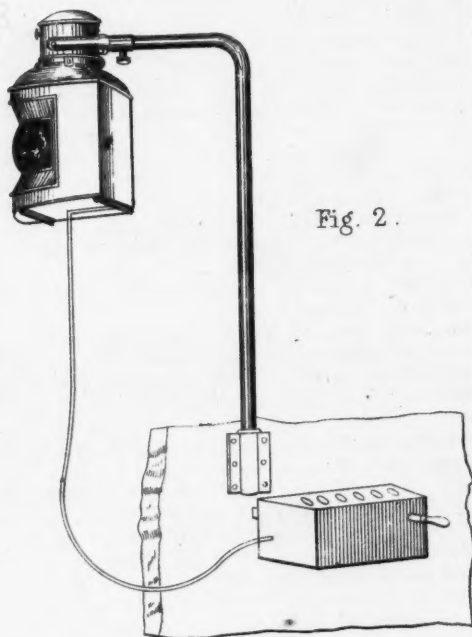


Fig. 2.

Fig. 3.



NOTE. The Scale of Fig. 1 is larger than that of Figs 2 and 3.

tration by a weaker light impossible. I had thought so much over the means of making such a light as we wanted, that I was myself inclined to desert the cause; but Captain Bolton was not quite so ready; he said, "Surely, if we put our heads together, we shall be able to devise "in the course of a very little time, some light that will do what we "want." As we were walking together and arguing the point, as we had done a good many times before, he said, "Why not try what they "make lightning with at the theatres—why not try resin?" We tried it, and in the course of six weeks we completed the light which I am now about to show you. I may mention that a number of these lights (Captain Colomb here exhibited the light) were sent out to Abyssinia, and we believe were constantly used during the whole of the campaign.

Mr. STERLING LACON: For how long is that light charged?

Captain COLOMB: That light, as it stands, is charged for about a week's ordinary work. The way in which that light is produced is very simple indeed. Any impalpable powder may be burned in it, so long as the powder is not explosive. It must be a powder which is inflammable, so long as it does not make its own oxygen. Coal dust, resin, potassium, or magnesium, or any light powder which is inflammable, may be burned. The way the lamp is arranged is as follows:—(Fig. 1.) There is an outer casing and an inner chamber which terminates in a narrow neck, then splits into two or three shoots, so constructed as to throw the powder issuing from them on to a central point. The outer chamber is filled, through this orifice, with the powder you intend to burn, but leaves the inner chamber full of air only. Through the bottom of the outer chamber comes up an air tube, the muzzle of which is bent downwards. When you force a jet of air through the tube it is deflected and plays upon the surface of the powder in the outer chamber, it just slightly disturbs it, and fills what was before filled only with air, with a light powder in suspension. Now the two or three orifices—three we find best—are much larger in area than the entrance of the air-pipe, the consequence is, that the air comes in through that entrance in a sharp jet, but issues through the pipes slowly and gently, bearing with it the powder in suspension. Here is the flame of a spirit lamp, and the moment a pressure of air is brought through the pipe, it plays on the flame and you get your light.

I will now show you some of the ingredients that may be burned. The composition we prefer to burn is composed of resin, lycopodium, which is the seed of a moss, and magnesium. You make the light more or less brilliant according to the quantity of magnesium you put into it. This signal light has one great advantage which we did not look for when we commenced our operations, but which we find now most useful, viz., that you can have in the same lamp just the range you like. You have only to alter the composition and put in stronger or weaker composition to get a greater or less range, so you need never have an expensive light for a limited range. In a fleet, for instance, the rear ships may burn a composition which will cost them perhaps half-a-crown an hour if they are constantly signalling. The ships nearer to the flag-ship, the leaders and those close astern of the flag-ship, will perhaps burn a composition that will cost sixpence or eightpence an

hour. In thick weather, again, you would burn a composition which would cost you probably three shillings an hour.

I will now burn some of the different ingredients in these little lamps that I have had made for experiments. This powder is simply powdered resin. The principle of the lamps is exactly the same as that of the larger ones, only there is one jet instead of two. This that I am now burning is lycopodium. It does not give much light, but it assists the composition, and is a good diluting power. We will now take some of the weaker powder. This we call the "Chatham powder;" and we call the light the "Chatham light," because it was while we were engaged at Chatham that we brought it out. This again is some of the stronger composition; there is there a little magnesium, a little lycopodium, and a little resin in it. First, we tried plain resin; then plain magnesium: then we came to this mixture. You may make it as strong as you like, so long as you do not burn pure magnesium. The difficulty with it is, that it is a little too inflammable. The light is very brilliant, but the composition is a trifle too inflammable. There is this danger with it, that if a spark did fall down—I do not say it would, still it might—if a spark did fall into the powder in the lamp, the powder would be liable to catch fire with the next blast of air that went in. It would not explode, but it would destroy the lamp, but that is all that would happen; the powder burns with a very fierce flame when a jet of air is thrown upon it. This (see Fig. 3), is another form of the lamp, and is intended for fixed stations. The light is only in one direction. It is of course very strong, and you see that it is quite under command. The working of it is very easy, that you can work it in fact with your finger, and yet get the full power. That is the light which I believe will be adopted for fixed stations. It is the best that we can get, it is the cheapest and the most powerful, with the exception of the lime light. This lamp weighs 5 lbs., and costs about 10 guineas; it carries in it as it stands, provender for a month. The last thing we had to attack was to give the mechanical arrangement for naval signals (Fig. 2); because although on shore we dispense almost entirely with mechanical arrangements, yet the more we have gone into the question, the more satisfied have both Captain Bolton and myself become, that although on board ship the system of flashing signals at night was not likely to fall through, still it would become discredited when communications had to be made to a number of points, such as the ships of a fleet, unless we had some sort of mechanical appliance to assist the repetition, and at regulated intervals. We have always found it impossible to get any man—no matter the amount of training that we have been able to give him—continually to measure intervals, as a revolving light-house gives them; and unless the whole of the flashings and signals are measured—as a revolving light would measure them—any observer is apt to lose part of the signal just at the moment he wants to read it. His eye gets tired, and he waits for a repetition, which does not come, because the other man is hoping that somebody else is giving an answer, and he does not go on steadily repeating the signal so as to assist him. This light before us is somewhat rough still, but I believe

that we shall be able to get the ship apparatus in very nearly the same form as the present ship lamp. I also believe that we shall be able to get the whole light a good deal under the cost of the present apparatus, although we shall have a light of twenty or thirty times the power. (Captain Colomb then made bright flashing signals for Nos. 2,442 and for 7,890.)

General BOILEAU: The bellows nozzle keeps the air-chamber full?

Captain COLOMB: The air-chamber keeps full of itself; the powder being a powder and not a liquid it does not flow up into the air-chamber.

Admiral KEY: But if you carry or shake the lamp about, is there no chance of the powder filling the air pipe?

Captain COLOMB: We have never found it do so, but should it so happen you have nothing to do but to empty it.

Admiral KEY: But you would not find it out till you began to signal?

Captain COLOMB: We have never found it so; of course if you turn the lamp upside down you would not probably be able to signal for two or three minutes afterwards. And you might get obstructions in the pipes; it is not likely that you would, but sometimes you might.

The CHAIRMAN: Has that apparatus been tried at sea?

Captain COLOMB: Not the apparatus; the light has been tried.

Mr. Sterling LACON: You have shown us three different materials, and you have also shown us the instrument charged for a week. What would be the cost of charging the instrument for a week with the three different materials?

Captain COLOMB: I am afraid that that would be rather a matter of calculation, but you can take it in this way—the composition of this lamp, the bright composition, costs about 2s. an hour for ordinary signalling; I suppose you would get four hours' signalling for a week. When I say for a week, I suppose you get about four hours' signalling in a night—that is rather a large amount; the cost of that is about 2s. an hour. This weaker composition that I showed you costs about 8d. an hour.

Captain BURGESS: How many signals can you make in a minute?

Captain COLOMB: You get about one signal or two words per minute, or sixty signals an hour.

Captain DAWSON: Which are the lamps that have been taken to Abyssinia?

Captain COLOMB: This one (showing the lamp). In Abyssinia the signals are made in the day time by means of flags, by waving flags from right to left, and it was necessary to provide in the simplest way we could a flag-staff for the signal lights. The flag goes on the top of the lamp; the signal-man waves his flag thus (showing the short flash), and completely down for the long flash; this plan is visible with a good telescope at a considerable distance, and is very rapid; it is the most efficient means of signalling in the day time on land that we have been able to devise.

Admiral KEY: What is the size of the flag used in Abyssinia?

Captain COLOMB: About 4 feet 6 inches, but I believe we shall reduce it to 3 feet square.

Captain BOLTON: Three feet square will give a range of ten miles with good glasses.

A MEMBER: What are the colours of the flags?

Captain COLOMB: The flags are of three colours—all black, all white, and black and white diagonally. The signalman on taking up his position by means of pointers, if he has the sky behind him as a back-ground, uses the black flag; if he has trees or rocks, or anything that will form a dark back-ground, he uses the white flag; if it be a doubtful back-ground, he uses the white and black flag, which is seen against any back-ground.

The CHAIRMAN: We all, I am sure, return our best thanks to Captain Colomb and Captain Bolton, for we rarely, I think, see a device so complete as this apparatus appears to be, so ingeniously put together, and so clearly explained.

Evening Meeting.

Monday, June 15th, 1868.

MAJOR-GENERAL J. T. BOILEAU, R.E., F.R.S., in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 15th June, 1868.

LIFE.

Meade, Hon. Herbert, Lieut. R.N. 9/.

ANNUAL.

Trevelyan, Sir Charles E., K.C.B., late Governor of Madras. 1/.

Parry, Richard, Cornet late 2nd Roy. N.B. Drags. 1/.

THE CONSTRUCTION OF HEAVY RIFLED ORDNANCE.

By Major W. PALLISER, Unattached, late 18th Hussars.

THE last time I had the honour of reading a paper in this Institution, I described two separate methods of constructing guns composed of a combination of cast and wrought iron.

The first of these related to the insertion of strong barrels of wrought iron into cast-iron casings, the second to casting casings of molten metal round wrought-iron barrels placed in a mould.

The first of these plans has since the date of that lecture proved successful, and has been definitely adopted into the Service, with a view of converting all the heavier natures of cast-iron smooth-bore guns into rifled cannon suited to the requirements of modern warfare. I have also found out by experiment since the above date, that the latter plan, namely that of casting the hot metal round the barrels, is not practical for producing compound guns on a large scale.

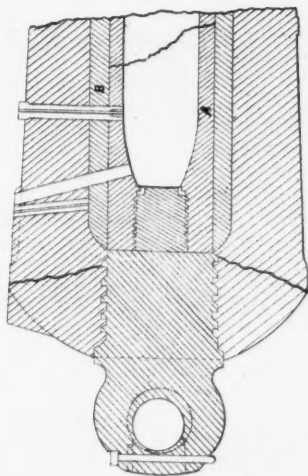
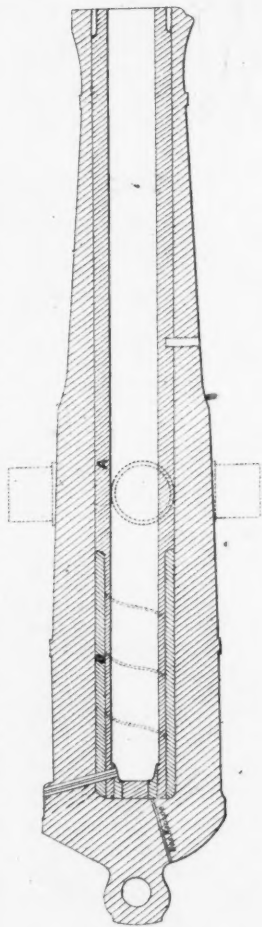
I shall, in the first place, make a few remarks upon the latter plan, with a view of explaining why the process itself of this mode of manufacture produces bad, or at all events uncertain results, and also to point out the valuable information that has been obtained by the trial of one heavy gun which was made in this manner.

At the date of my former paper that gun, a 9-inch rifled gun of 12½ tons, had fired 111 rounds, of 43lbs. of powder, and 250lb. shot.

I stated in my paper that "the coils which form the second length at the breech end of the barrel were imperfectly welded, and, in consequence, were separated one from another."

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Cast Iron Smooth bore, Converted on Palliser's principle into a Rifled Gun.



N^o 247 68 P. of 8½ Cwt. condemned after 373 rounds for fissures round the vent, lined 1864 in R. 6 F. with a double coiled tube, the A or inner tube of soft iron, the B or exterior tube of harder iron, calibre 7 in. It completed 800 rounds when the A tube split longitudinally. It was then retined as above and blew the breech out 6th April 1866, near 18,546, after 163 rounds, of which 83 with the full battering charge of a 7 inch 7 ton gun. The breech cracked at 162nd round of 2nd series. The tube did not break until the last round.

(Signed) J. H. Leifroy,
Brig^{er} General R.A.
Pres O.S.C.

In evidence which I had occasion to give before the Ordnance Select Committee on the 13th December last, alluding to the same gun, whose trial at that time had not been proceeded with, I said, in answer to question 240—"If marks of this sort were found in the gun close to the powder chamber I should reject it. . . ."

"I should reject the gun because, although I do not consider they interfere with the gun's strength, yet I think such marks as that would lead to distrust amongst Officers abroad, who were not thoroughly up to the matter, who, in fact, have not the same practical experience of testing by continuous firing guns with similar marks in their coiled tubes." . . .

Since the date of that evidence, the gun has completed its test of 511 rounds with battering charges.* The hollow screw collar at the muzzle, which is a peculiar feature of my plan of conversion, was omitted in this gun. It also happened that the barrel was very loose in the chase of the gun. The repeated vibrations of the very heavy charges cracked the barrel at the muzzle; the cracked portion expanded up against the cast iron surrounding it, and no further ill effects ensued. The accident served to prove to my mind the necessity for having a screw collar at the muzzle; the interior of this collar, as you will observe, is slightly rounded out. The effect of the pressure of heavy charges upon the barrel, is to compress the metal round the charge, and consequently to squeeze the tube out at the muzzle, much in the same way that moist colours are squeezed out of the small metal bags in which they are usually contained; when, however, a screw collar is employed, the tube becomes jammed into the rounded interior, and thus all vibration is checked. In no case in which the screw collar has been employed, has the barrel cracked at the muzzle.

Although I do not intend to persevere in the plan of making heavy guns by casting the hot metal round the barrels, I think I can shew that the cost of firing the 9-inch gun, has been money well expended. In the first place the rifling in that gun was not carried down into the powder chamber, whereas, in a wrought-iron 9-inch gun, lined with a similar barrel, and rifled with similar grooves, the rifling was carried down to the powder chamber. In the latter gun the barrel began to split at an early stage of the experiment, and was completely split through when the programme was about half finished.

* "Since the date of this report, 9-inch gun No. 293, made with a coiled iron barrel, double at the breech end, with a cast-iron exterior (cast round the tube) has completed 511 rounds, viz. :—

"In smooth bore state—

Charge, 55 lbs.	Shot, 250 lbs...	..	..	2
" 43 lbs.	" 250 lbs...	..	..	18

"After rifling—

Charge, 55 lbs.	Shot, 250 lbs...	..	..	2
" 45 lbs.	" 250 lbs...	..	..	87
" 43 lbs.	" 250 lbs...	..	..	402

511

"The tube has split from the muzzle about half its length down, and was in this condition during a large part of the test."—Ordnance Select Committee Report, No. 4,888, Jan. 29, 1868, page 12.—20th July, W. P.

The former gun (namely, my gun) completed the 500 rounds without splitting the barrel down the powder chamber.

The charges of both guns were alike, and were fired in the same manner, and thus a conclusive proof of the value of a smooth bored powder chamber was obtained.

2. All 9-inch guns that had previously been fired, required re-venting after a limited number of rounds. The vent of my gun was fitted in a peculiar manner with Messrs. Johnson and Mathey's alloy of platinum, and completed the 500 rounds without receiving a new vent, thus confirming the trial of my 7-inch gun, converted from a 68-pounder, which in 1865 fired 800 rounds without requiring a new vent.

3. In my previous lecture, I stated that "every way of regarding the subject shews that the circumferential strength should be applied internally, and that the longitudinal strength should be borne by the outside. And this is precisely the reverse of the principle on which the wrought-iron guns of the service are made."

The trial of this gun has since conclusively proved the truth of that remark. I have already shewn that the interior coils were separated, and, therefore, it follows that no longitudinal strength could be conferred by the barrel.

A wrought-iron gun, No. 287, burst into two pieces at the 104th round on the 25th July, 1865.—(See War Office Parliamentary Return, April 18th, 1866.) The cause of this failure was that the gun was nearly bisected in rear of the trunnions, where the thick breech coil met the trunnion ring. The uniformity of longitudinal strength was in this manner destroyed; the absolute necessity for this uniformity was not, even at that late date, understood. The blame, however, was laid upon a circumferential flaw in the barrel. However, in the second gun, turned out at the same time, the real defect was remedied by removing the breech coil and hooking it over the trunnion coil. This gun, however, burst with violence at the 368th round.

A 10-inch gun at Shoeburyness, blew its breech out about a year ago, when the blame was again laid upon a defective weld in the coiled tube. This gun, however, was one that was made before my proposal relative to the mode of closing the breech of wrought-iron guns was adopted. The barrel had been introduced from the rear, and the gun had necessarily a *minus* screw thread in the breech. Notwithstanding that it had a longitudinally forged solid breech-piece, the breech was blown out, the metal parting round the innermost turn of the female screw thread, as though it had been cut with a knife. Again, on the 12th November, 1867, I wrote to the Select Committee, stating that I had observed in the *Times* of that day that a 12-ton gun on board H.M.S. "Wyvern," was stated to have blown its breech out. I said, "If such be the case, I feel confident the gun must be one of those made before my proposal as to the screw breech was adopted, and that it would be found that the metal had parted round the innermost turn of the female screw-thread." My conjecture subsequently proved to be absolutely correct. My proposal ever since the year 1862 had been to substitute a stout coil next to the A-tube, instead of the solid

forged breech pieces, in order to prevent explosive bursting when the inner barrel became split. My 7-inch gun of 1864 had such a tube in it, and, in consequence, it fired 50 rounds without further injury after the tube split. It is evident, therefore, that the Superintendent of the Royal Gun Factory had forgotten this fact, when he stated (in reply to Question 63 of the Report of the Ordnance Select Committee, already referred to), "in connection with cast-iron you lose one advantage, "because if your tube goes, you have a treacherous metal outside." I now assert as a fact, that all the wrought-iron 9-inch guns which had solid forged breech-pieces round their inner barrels, have burst with violence into pieces, within a very few rounds after their inner tube had split; the reason is that the solid forged breech-piece possesses no circumferential strength, and the outer coils, in consequence of this very breech-piece, are too far off to prevent disruption with violence, after the barrel has split; for, owing to their position, the force of the powder possesses a great mechanical advantage over the resistance opposed by the outer coils. If thus it has been conclusively proved that *outer coils* are incapable of preventing violent disruption, I ask what advantage do they possess over cast iron?*

The trial of my 9-inch gun which commenced on the 5th September 1866, proved that the solid forged breech-piece was unnecessary for longitudinal strength, so long as the breech was closed with a *plus* screw-thread, and the barrel introduced into the casing from the muzzle, instead of, as formerly, from the breech. The solid forged breech-piece has in consequence been dispensed with in all the heavy muzzle-loading guns of the Service, with very satisfactory results. I trust I have succeeded in showing, that the trial of this gun has proved, 1stly, the value of a peculiar mode of applying platinum to the vent; 2ndly, the great value of a smooth-bore or unrifled powder chamber; and, 3rdly, that the solid forged breech-piece, so fatal to circumferential strength, was unnecessary for longitudinal strength, so long as a *coiled breech-piece* was combined with the *plus* screw-thread in the breech.

Simultaneously with the trial of this gun, I constructed two others, viz., a 12-inch gun of 18 tons weight, and another 9-inch gun, similar to the one above alluded to.

The 12-inch gun burst with violence on the first round with 100 lbs. of powder and 400 lbs. shot. On testing the fractured portions of this gun, I found that the cast iron broke at strains, ranging from 5 to 6 tons; further, that specimens, 2 inches long between the bearings, which were cut out of the wrought-iron thick-coiled breech-piece, snapped, in one instance, under a strain of only 13 tons to the square inch, and that it only stretched $\frac{1}{12}$ th of an inch, whereas all the similar specimens cut from the inner or A-tube, went up to a strength of about $22\frac{1}{2}$ tons, and stretched half an inch. The reason why the cast iron was so weak was, that with a view of preventing its in-

* Since writing this paper, one of the wrought-iron 9-inch 12-ton guns, lined with a steel tube, burst with violence at proof into 18 pieces, some of which were thrown to a distance of several hundred yards.—W. P., 25th November, 1868.

ternal surface from becoming chilled by contact with the wrought-iron interior tube, I had purposely selected the very softest brand of cast iron I could obtain. I was not, however, aware, until after the guns had been made, that this brand of iron would have become so weak when employed in large masses. It follows, however, that if the iron in the casing of the 9-inch gun which fired 500 battering charges, is only (as I suspect) up to a strength of 5 tons to the square inch, casings possessing the usual strength of cast-iron guns, which varies between $10\frac{1}{2}$ and 12 tons to the square inch, will be quite strong enough.

The cause of the difference of strength of the wrought iron in the thick B or outer tube, and that of the inner or A-tube, is as follows:—

In casting these guns, a powerful current of air was driven through the inner barrel, and, notwithstanding the great heat and mass of the cast iron, this current sufficed to prevent the inner barrel from ever being raised beyond a red-heat.

On the other hand, the B, or outer tube, which at the breech end of the barrel was alone in contact with the molten metal, expanded away from the inner tube, and thus the continuity of conduction became broken. The B-tube in consequence, became heated over welding-heat, and the quality of the wrought-iron became thereby destroyed. To illustrate this, I would observe, that if a bar of wrought-iron be put into the fire, and raised above a welding-heat, and then suffered to cool gradually, without being hammered, the same iron which previously had possessed the strength of 23 tons to the square inch, would be found to possess only that of about 13 tons, and further, that its extensibility would have been completely destroyed.

The bursting of my 12-inch gun shook my faith in this mode of manufacture, and I determined to ascertain whether the 9-inch gun was similarly defective. I accordingly began by proving it with two rounds of 55 lbs. of powder and 350 lb. shot, instead of the service proof of 250 lb. shot. I further caused the vent to be moved forward some $10\frac{1}{2}$ inches from the breech-end of the bore, and resolved to fire from it 100 proof rounds of 55 lbs. of powder and 250 lbs. shot made up in the most trying manner. The vent was advanced to the above position purposely to make the strain as great as possible. It is usual in firing all heavy guns, to make up the charges to a considerably less size than the bore of the gun, as it is found that this arrangement materially diminishes the first shock upon the gun. But in order still further to increase the strain, I made up the charges to the full size of the bore. The gun burst at the second of these rounds. The outer or B-tube split right down its entire length, the two large pieces of cast-iron, from the upper side of the gun and extending from the trunnions to the breech, were thrown, or rather fell over the sides of the carriage. The carriage, however, was not injured. No lateral explosion took place, for the inner or A-tube, which had not been damaged by the action of the heated metal in casting, did not burst.* The longitudinal support,

* This tube expanded upwards of half an inch, *i.e.*, it elongated in its circumference upwards of $1\frac{1}{4}$ inches.—W. P., 25th November, 1868.

however, to the breech having been torn off its upper part, and the breech being held only by the cast-iron on its lower part, it was blown down and bounded away to the rear to the distance of thirty yards.

When it is considered that this gun was similar in all respects to the 9-inch gun, which had endured 500 battering charges, and further that it had passed the excessive proof of two rounds of 55 lbs. of powder, and 350 lbs. of shot, I think it will be admitted, that in all probability it would have gone through the test of 500 battering charges, which the sister gun had endured.

My faith in the system of casting casings round the barrels had, as I have already observed, received a severe blow by the bursting of my 12-inch gun, and, such being the case, I considered it imperative upon me to sift the matter thoroughly, and not to try and bolster up a mode of applying the general principle of construction, which the bursting of my 12-inch gun led me to think was a bad one, and I came to the conclusion in my own mind, that unless the 9-inch gun would stand 100 rounds of excessive charges, such as the above, it would not be a fit gun for me to propose for introduction into the Service.

It failed under the test, and though it is not without some feelings of regret that I now abandon a mode of manufacture upon which I had spent much time and money;* which presented such strong promise of success; and which, had it succeeded, would have enabled the heaviest cannon to have been produced at a very rapid rate, and at very low cost: still that feeling is counterbalanced by the satisfaction to myself, of knowing that the spirit in which I have conducted these experiments, has been one which renders the introduction of an inferior class of gun, impossible. I shall confine future experiments to casting large casings separately, and lining them afterwards.

I now come to that portion of my subject which relates to the conversion of existing cast-iron guns into rifled ordnance suited to the requirements of modern warfare. I am happy to say that the experiments upon *this* mode of constructing guns have led to a result very different to that just described, inasmuch as the Ordnance Select Committee, after a long and careful inquiry extending over six years have come to the following decision. I quote their words:—

“The Committee do not hesitate with these facts before them, to recommend an extensive conversion, of our present cast-iron smooth-bored guns, into rifled guns, with linings of coiled iron, for secondary purposes of defence.”

The recommendation of the Committee has been accepted by the authorities, and a large number of guns has been ordered for conversion. My remarks *now*, will therefore touch upon that which is the actual *matériel* of the Service, and consequently will, I trust, possess greater interest on account of the subject not being any longer speculative.

* It is right to state that the 12-inch and the 9-inch guns were made at my own cost, as well as most of the converted guns which have been experimented with, as it has been stated in the *Engineer* that these experiments were made at the public expense.—W. P., 25th November, 1868.

I would remind you, that in my lecture of last year, I explained, that the mode of converting cast-iron guns, consisted in boring up the casing and accurately fitting into it, two wrought-iron coiled barrels, one inside the other. I showed that the object of employing two thin barrels, instead of one thick one, was not for purposes of obtaining greater strength, but to break the continuity of any internal fracture that might occur. As I have frequently been asked why I prefer coiled wrought-iron barrels to steel, I will state my reasons, which are as follows:—

1st. Coiled barrels are cheaper.

2ndly. They admit of being inserted loosely into the casing, and set up inside it by heavy proof charges with absolute certainty.

3rdly. That coiled wrought-iron resists the abrasion or scoring caused by the action of the fired gunpowder, much better than steel.

4thly. The soft coiled iron barrel is more extensible than a steel one, and in stretching excites the assistance of the outer portions of the gun to a considerable extent, before internal fracture can possibly commence.

5thly. That it merely *bulges* under the premature explosion of shells in the bore of the gun, or when excessive charges are employed, while the steel barrel under the same conditions is liable to burst.

6thly. The absolute certainty of uniform strength possessed by the coiled iron barrel as compared with that of steel.

The objections against coiled barrels are as follows:—

1st. That coiled barrels are liable to circumferential flaws and bad welds, and should the barrel be not sufficiently welded, the coils are apt to separate in the powder chamber, under the action of heavy charges.

2ndly. That the coiled iron barrel possesses very little longitudinal strength.

3rdly. That the rifled grooves do not so well resist the continual wear of rifled shot in their driving edges.

I now proceed to notice the above statements in detail, and in doing so shall quote from the evidence given before the Ordnance Select Committee. Some of this evidence is of the greater weight, as it is that of Colonel Campbell, Superintendent of the Royal Gun Factories, who advocated generally the employment of steel in preference to coiled wrought-iron.*

With reference to my 1st statement, "that coiled barrels are cheaper than steel;" Question 71, Ordnance Select Committee Report.

Speaking roughly, what is the ratio of steel and coiled iron for an A-tube? Is it 3 to 2, or 2 to 1, or what?

Answer, by Colonel Campbell, Superintendent Royal Gun Factories.—"If your coiled tube was right the first time, you would make two or perhaps three coiled tubes for one steel one, depending on the size."

Question 72.—"Do you mean that you could make three coiled

* It is right to state that the introduction of Marshall's charcoal iron for making coiled barrels is due to Colonel Campbell, as he was the first person who definitely proposed this peculiar kind of wrought iron, and succeeded in *proving* its value. —W. PALLISER, 28th July, 1868.

tubes of Marshall's iron for one of steel?" Answer "Yes, for large guns."

My 2nd statement was, "that the coiled wrought-iron barrel admits of being inserted loosely into the casing, and set up inside it by heavy proof charges with absolute certainty."

My proof consists in the fact of several dozen guns having been converted and "set up" in this manner without a single failure, or any difficulty having occurred.

3rd statement—"That coiled wrought-iron resists the abrasion or scoring caused by the action of the fired gunpowder, much better than steel."

The 70-pounder Armstrong gun employed in the competitive trial with the Whitworth gun, was lined with a steel barrel. For a considerable number of rounds, wads were employed to check the escape of gas over the projectile, and thereby prevent the scoring. These wads were dispensed with at one part of the trial, and the result was, that the tube became much scored, or as it is technically termed "guttered," and the barrel cracked in the rifle groove. On the other hand a 32-pounder converted into a rifled 64-pounder gun* by means of a coiled barrel, has lately completed 2,286 rounds without wads having been used at all. The gun is but slightly scored. The last 80 rounds fired from it were with double charges of powder. Furthermore two 68-pounders† have been converted into lined 68-pounders, by means of coiled wrought-iron barrels, and have each fired 1,000 rounds with scarcely any marks whatever. Both guns are serviceable, and have been re-issued to Her Majesty's ship "Excellent."

4th statement—"The coiled wrought-iron barrel merely bulges under the premature explosion of shells in the bore of the gun, while the steel barrel under the same condition is liable to burst."

A few months since, a double shell containing 11 lbs. of powder, burst accidentally in the muzzle of a 6½ ton 7-inch wrought-iron gun, lined with a steel tube, on board the iron-clad ship "Lord Clyde," on the 29th November, 1867, and blew away the muzzle of the gun. In full knowledge of this fact, I deliberately fired five shells, each containing 12½ lbs. of powder, out of an 8-inch rifled gun, converted from an old cast-iron 10-inch shell gun, of 84 cwt. The charge employed was 22 lbs. of powder, and holes were bored through the bases of the shell. Four of the five shells burst in the inside of the gun, and the effect was merely, that the barrel was slightly bulged where each burst took place.—(See Ordnance Select Committee Report, page 7, No. 4,888.)

The same experiment had been previously made by me with a 64-pounder converted from a 32-pounder cast-iron gun, when 5 shells, each containing 4½ lbs. of powder, were intentionally burst in the bore, without any serious effects. In both cases the guns were loaded afterwards without any difficulty.—(See Ordnance Select Committee Report, as above.)

5th statement—"That the soft coiled iron barrel is more extensible than a steel one, and in stretching excites the assistance of the outer portions of the gun to a considerable extent before internal fracture can

* Experimental number, 348.

† Experimental numbers, 283 and 284.

possibly commence." The 64-pounder which I have just alluded to, was tested to destruction by increasing charges, when it eventually failed by harmlessly cracking the outer casing.

The barrel in this gun was bulged a quarter of an inch. It was otherwise uninjured, and has been since placed on another casing, which has passed proof satisfactorily.

Even in the case of the 9-inch gun which burst the other day, the wrought-iron barrel has expanded to an extent of half-an-inch, without showing any signs of cracking.

6th statement—"The absolute certainty of uniform strength possessed by the coiled iron barrel as compared with that of steel."

In the year 1863 a cast-iron gun was tried with a double barrel composed of a steel tube inside another of wrought-iron, the steel barrel was tempered in oil in the manner pursued in the Royal Gun Factories. On the 29th September, 1863, I wrote to the Select Committee, *before the gun was tried*, and pointed out that I considered the steel to be too highly tempered, and that it would probably split in a few rounds. When the gun was proved, it split at the first round right down its whole length with a charge of 28 lbs. of powder, and a shot of only 68 lbs. weight. The coil tube outside the steel one kept the gun together, and prevented a burst from taking place. It is true that the barrel in question was too highly tempered, but the accident shows that slight inattention to the precise quality of the steel, or to the tempering of it, may lead to serious consequences in converted cast-iron guns, although the same contingency may not apply to steel tubes tightly bound up within super-imposed coils of iron or steel.

My opinion as regards the greater reliability of the coiled wrought-iron barrel for preventing a lateral burst, is confirmed by the replies of the Superintendent of the Royal Gun Factories, in the examination already alluded to.

Question 60 before the Select Ordnance Committee.

With reference to coiled barrels :—

Q. "You do think them unsafe?"—A. "Not if your gun is longitudinally strong."

Q. 262. "But not for bursting?"—A. "For bursting. My opinion is that they are really better than steel. As regards a bursting strain, I would rather stand by one without a steel tube than one that had it."

And now with regard to the objections which are urged against the coiled barrels.

1st. "That coiled barrels are liable to circumferential flaws and bad welds, and should the barrel be not sufficiently welded, the coils are apt to separate in the powder chamber, under the action of heavy charges."

I have already pointed out that the wrought-iron barrel, in the 9-inch gun which fired 500 rounds, was badly welded in the powder chamber, and that the coils were in consequence separated in the firing; that I had stated, previously to the trial of the gun, that I should not have passed such a barrel into the service, but that I wished the gun to be fired in order to prove the little importance of such defects. The trial of that gun, which completed its endurance test of 43 lb. charges, with

250 lb. shot, has since proved the justice of that opinion. Further, a 32-pounder gun converted into a 64-pounder rifled gun by the Elswick Ordnance Company—one of 20 similar guns for the colony of Victoria—was rejected for having circumferential flaws in the powder chamber.

My answers to the Ordnance Select Committee with reference to this gun, and previous to its trial, were as follows:—

Q. 268. "You are aware that we are going to test two of the lined 64-pounder guns for endurance until they burst?"—A. "Yes."

Q. 269. "One of those was a gun that was rejected at proof?"—A. "Yes."

Q. 270. "You voluntarily put forward that gun to undergo this test, from a belief that the cause for which it was rejected does not affect its strength materially?"—A. "Yes, just so."

Q. 271. "And we may accept the results with that gun as perfectly as if it had not been rejected?"—A. "Yes, I think so. At the same time I should wish to state that I have not taken exception at the gun having been rejected. I have not stated that the gun ought not to have been rejected. My great object in firing with that gun, is to prove of how very little importance circumferential flaws are in a coiled barrel, rather than to seek to prove that the gun was improperly rejected, because after all it is a matter of opinion as to what constitutes a flaw for rejection."

Now that is the gun which completed as above stated, 2,286 rounds. The circumferential flaws have undergone little or no attention during trial. The last 80 rounds were with double charges, and the two wrought-iron guns of similar size with which this gun was compared, had burst with violence respectively at the 2,211th and 2,273rd rounds. Moreover, the 2nd wrought-iron gun had been repaired twice after it had fired 2,000 rounds.

The firing was discontinued with my gun in order to save unnecessary expense. The result had been so completely satisfactory, that the trial of my second gun was dispensed with altogether, as it was considered quite unnecessary. I would remark that both the wrought-iron guns were especially prepared with a view to being tested by continuous firing, whereas mine was a rejected gun out of a contract supply. I may state that the manufacturing difficulties which led to the separation of the coils have lately been completely overcome by the Elswick Ordnance Company, so much so that on a recent occasion the Ordnance Select Committee wrote to me to ask, whether the barrel in a gun which had endured an excessive test was really composed of coiled wrought-iron, because it was so perfect that they could not detect the slightest coil-mark in it. This excellence of manufacture is due partly to the experience of the Elswick Ordnance Company, and partly to the introduction by them of a new process which I may not be at liberty to explain.

2nd objection—"That the coiled barrel possesses very little longitudinal strength."

I fully admit the truth of this statement, but the leading principles in my converted guns are, to throw the longitudinal strain

on the cast iron outer casing by allowing the tube to abut against it, and to depend upon the double coil at the *inside* of the gun for the lateral or transverse strength. In my former lecture I shewed, that by transferring the total pressure of the discharge on the end of the bore of a gun to a larger area, you diminish the pressure on the square inch on the larger area, and thus increase its powers of resistance in a direct ratio. However, as facts are better than theories, I may state that of all the guns tested by me with excessive charges, in no case has the solid-ended gun blown its breech out.

Two guns which had been fitted with false cascables for experimental purposes, blew their breeches out in the manner shown in the above diagram. The barrels of both these guns were taken out and put into two other casings; one of these has fired, amongst other severe charges, 2 rounds of 37½lbs. of powder and 180lb. shot, and 60 rounds of 30lbs. of powder and 180lb. shot. When the weight of this gun (only 4½ tons) is considered, and that the battering charge of the 7-ton 7-inch rifled gun is only 22lbs. and 115lb. shot, you will be enabled to judge of the extreme severity of this test. Several wrought-iron guns, made before my proposal relative to closing the breeches of such guns had been adopted into the Service, have blown their breeches out, but no wrought-iron gun has done so, whose breech is closed in accordance with my patent.

It would be as unfair to state that such wrought iron guns are weak longitudinally because several of a previous and inefficient construction blew their breeches out, as it would be to assert that the cast iron lined guns are weak longitudinally, on account of the failure of two guns with badly patched cascables. Not only has no solid-ended converted gun of mine ever blown its breech out, but no converted gun of mine—not excepting the two above-mentioned failures—nor those guns which were tested to destruction with charges increasing in severity, has ever burst with violence, without having previously given distinct warning that its existence had come to an end.

In proof of this assertion I would state, that my two first guns were tested to destruction by cylinders increasing every 10 rounds by the weight of one round shot from 68lbs. up to 680lbs. The first gun went through the endurance test without bursting. This gun was lined with a single barrel representing the Service converted gun (which is lined with a *double* barrel) with its inner barrel removed. It became manifest at the end of the trial, that this barrel was eaten deeply into by the action of the powder firing the heavy cylinders. On the completion of the first test, I informed the Committee, July 11th, 1863, that the gun had become unserviceable, and requested leave to repair it.

My second gun was converted into a 6½-inch gun, and subjected to a similar test. At the 78th round, the inner barrel cracked under the enormous strain caused by firing cylinders upwards of 5 feet long. I thereupon wrote to the Committee, November 29th, 1863, and asked to repair this gun, too. In both cases I was refused, as the Committee were not anxious to see how much would be got out of a gun under the most favourable circumstances, but rather to ascertain its

ultimate strength by means of a crucial test. I quite concur with the opinion of the Committee, and only mention the facts to show that even these guns had given premonitory symptoms. The 6½ inch gun with a cracked tube fired two rounds with cylinders weighing 534 lbs., and burst on a third round, the weight of the cylinder being then increased to 599 lbs.

The 7-inch gun, with the patched cascable, cracked round three parts of its circumference, at the 904th round. You could have put your hand into the crack. I purposely fired another round, and blew the breech to the rear. My object was to see whether the gun would burst laterally, and this it did not do.

3rd objection—"That the rifled grooves do not so well resist the continual wear of rifled shot on their driving edges." This objection was foreseen by me from the first, and it was on this account that I proposed accelerated rifling, which reduces the pressure on the driving edges of the grooves to a minimum. It has, however, been proved, *à fortiori*, that such rifled grooves in a coiled barrel will stand the test of continuous firing. With this object, the 68-pounder, converted into a 7-inch rifle gun by means of a coiled barrel, was rifled with an accelerated spiral, with a final pitch of one turn in 28 calibres. The quickest pitch in the service being one turn in 40 calibres. That gun fired 800 rounds, and the projectiles were fitted purposely with only one stud in each groove, in order to test the resisting powers of the rifled grooves to the utmost. The result of the trial was that the grooves were worn to a certain degree, but not to any serious extent.

I will now mention a curious fact that I have lately ascertained with reference to rifling cannon. The shot at first lies on the lower surface of the bore, and the first effort of the rifling is, to lift it up, but the pressure of the gas escaping over the top, presses it down. The result of these opposing forces is, that the shot acquires an irregular motion in the gun, which leads to unsteadiness of flight and inaccuracy of practice. I admit, so far as the long shells are concerned, which are fired with comparatively small charges, that this evil does not make itself very apparent, but where short solid shot are fired with heavy battering charges, the practice becomes very wild, especially when the large amount of windage is allowed which practical Artillerymen will insist upon as a *sine quâ non*. I hence found that by rifling the gun eccentrically to the bore, and by causing the grooves to assist instead of opposing the combined effects of gravity and the escape of the gas, and thus obliging the shot to remain eccentric to the bore of the gun on its passage out, to the same extent as it was in the position in which it originally lay, the most remarkable results in accuracy have been obtained in firing, with battering charges, short chilled shot having plenty of windage. It is remarkable how completely this result differs from all previous theories, the common object of all systems of rifling having been, to centre the shot in the gun during its passage out.

In conclusion I wish to state my opinion, that before a new pattern gun is introduced into the Service, it should pass through three separate tests.

1st. The test of destruction by charges gradually increasing in severity, in order to ascertain that the ultimate strength of the gun is fully up to the required standard.

2ndly. It should endure, without injury, a moderate number of rounds—say from 50 to 100 with charges greatly in excess of anything which the gun by any possibility can be called upon to fire, in order to show that it possesses a satisfactory margin of strength to resist *repeated* severe strains without deterioration.

Lastly. The continuous firing test of the largest charges which the gun can be called upon to fire in service, in order to prove that its lasting powers are beyond doubt.

The Ordnance Select Committee state in their Report that they are not yet prepared to recommend the full battering charge of the 7-ton 7-inch wrought-iron gun for employment in the 7-inch converted 68-pounder which weighs five tons.

For the present I fully concur in their views. The 68-pounders converted into 7-inch guns, have endured most satisfactory the first and second tests above alluded to. Three of them are undergoing very satisfactorily the third or continuous test with the battering charges in question. Until, however, the third test is completed, it would be premature to assign so heavy a battering charge to the 5-ton gun.

I have of my own accord continued the tests of these guns with excessive charges, since the date of the favourable report of the Select Ordnance Committee. I am aware that in doing this I incur a certain amount of risk, for, in the event of any failure, much capital would no doubt be made of it by those who are opposed to my views; but, looking at the awful consequences which might attend the violent bursting of a heavy gun, I would much sooner that the whole system should break down even now at the eleventh hour, than that a doubtful gun should be introduced into the Service with my name associated with it.

Captain CHARLES M. MOLONY, R.A.: The lecturer has alluded several times to Colonel Campbell, the Superintendent of the Gun Factories. As I am his assistant, and he is not present, I should like to make a few remarks upon this lecture. It is not my purpose to follow the lecturer through all he has said: I could not do it this evening, and you would not listen to me if I attempted it. But there are a few points on which I think some of the things that have been said are not justified by what is really the case. It is quite true that the Ordnance Select Committee have recommended, and that the Secretary of State for War and his Royal Highness the Commander-in-Chief have approved of these cast-iron guns being converted into rifled guns with linings of coiled iron *for secondary purposes of defence*. But that recommendation at present is limited only to guns of certain natures. I do not wish to quarrel with that. I do not say that they have come to a wrong conclusion. They have had numerous experiments, and they ought to know whether it is safe. But the lecturer has taken from that an argument in favour of a wrought-iron barrel, with a cast-iron exterior, as against a steel tube and a wrought-iron exterior. So far from that being the case, it is just the contrary. In this Report, the Ordnance Select Committee recommend that *all new guns* should be made with a steel interior and a wrought-iron exterior. The lecturer has stated that the wrought-iron tubed gun which stood 2,000 and odd rounds, was fired against two 64-pounder guns with iron barrels and wrought-iron exteriors, which burst explosively. Now I do not think that that is a fair comparison. There was no comparison at all, in fact; and the Select Committee have acknowledged there was no comparison, although it has been persist-

ently put forward as a comparison. The fact is, this gun which stood this number of rounds, and which I believe is an excellent gun, was vented far back; the two other guns were vented forward. Now nobody knows better than the lecturer does the effect of that. I could quote from one of his pamphlets a passage, in which he says, that the effect of the charge on guns vented forward is double that on guns vented back. It is not fair to say that those two guns burst explosively, and that his gun did not burst at all, unless he states that fact with regard to the venting, I have also to state, that in saying that one of those guns burst explosively, he is not correct. It did not do so; the breech merely came off; it merely shed the breech; the breech and the muzzle separated. I believe that if either of those two guns had been fired with their vents in the position in which it is in Major Palliser's gun, they would have lasted to this time. In favour of that opinion, I may refer to the Whitworth and Armstrong 64-pounder guns; they were found perfect when they were bisected, and they had steel barrels with wrought-iron exteriors. The Committee did their very best to burst them, and they were not able to do so, and they afterwards bisected them to see the result of their labours. The lecturer has taken credit for a great many things being discovered by the trials of his three heavy guns. He has told you the history of all three of them, *and they were all three failures*. The first of them failed by the bursting of the interior tube; at the 182nd round it became unserviceable. No one in his senses would think of going on with a gun when he saw a great crack on the surface extending some way down. Major Palliser states that there was a defective weld in the chamber of that gun, which showed, by the gun not bursting, that there was no want of longitudinal strength in it; that the cast-iron bore all the longitudinal strain. But that defective weld never went through the barrel, and it fired 500 rounds. I do not know what the thickness of the barrel is, but the crack is only half-an-inch in depth; the wrought-iron bore the whole of it.

The CHAIRMAN: I believe the lecturer has stated that that system is altogether abandoned?

Captain MOLONY: A large portion of the lecture has been devoted to that point.

The CHAIRMAN: Will you confine your observations to the guns that have not been abandoned?

Captain MOLONY: I do not know that I have any more remarks to make upon the subject; but as Major Palliser was on the subject of heavy wrought-iron guns, I thought I might in fairness allude to it. At all events, it has been stated that the casting of that metal round the wrought-iron deteriorated it, and some cases have been mentioned in which it was so. Now, of that very gun which burst a few days ago at Woolwich, we took a piece for testing and found it was not deteriorated.

Major PALLISER: That gun was my property, and what right had you to do that? I said one specimen cut out of the 12-inch gun broke at a strain of 13 tons per square inch, and if one part of the barrel broke, it was quite sufficient, for the strength of a chain is measured by the weakest link.

Captain MOLONY: It did not deteriorate; the real truth was that the gun was inherently weak. When they cast the metal round the wrought iron, the wrought iron was expanded out to the metal; and when the gun cooled again, the wrought iron contracted from the metal.

Major PALLISER: Did you see the gun cast?

Captain MOLONY: No, I did not. Those are the points I chiefly wish to mention. I could mention many more, only the Chairman says there is not time.

Major PALLISER: Would you allow me to reply individually, because otherwise it would be impossible to remember all the objections that have been made? First of all, the Assistant Superintendent of the Gun Factories has stated, that the recommendations of the Select Committee was limited to certain guns. I have got their Report here.

"TABULAR ABSTRACT showing the natures of the cast-iron guns recommended by the Ordnance Select Committee to be lined and rifled. The number of each nature mounted on works of defence in the Land Service, 1864, exclusive of India and the number then in store, with the calibres, weights of projectile, and charge proposed for them in their rifled state are added:"—

	68-pdrs. of 66 cwt.	10-inch guns of 64 cwt.	8-inch guns of 65 cwt.	32-pounders.			24-pounders	
				62 cwt.	54 cwt.	56 cwt.	50 cwt.	46 cwt.
In the Land Service, 1884.	880	190	780	108	177	1,075	500	223
In store at Woolwich, 1885.	3880	141	280	18	340	338	480	478

This dispenses of the statement that the recommendation of the Committee was limited to only guns of certain natures, since the heaviest cast-iron guns in the service, namely 68-pounders and 10-inch shell guns, are recommended for conversion.

Captain MORRIS: But there are no 68-pounders for this year at all events.

Major PAINMAN: I took down your remarks, "the recommendation of the Select Committee was limited to certain guns." With regard to steel barrels, I distinctly said that I did not allude to a steel barrel which was bound up with super-imposed coils of wrought-iron. I alluded to steel barrels as compared with wrought-iron barrels for the purpose of converting cast-iron guns. I do not wish to enter into the discussion as to the relative merits of guns which are tied round with super-imposed pieces of iron. Then, with regard to the guns converted being for the secondary purposes of defence, I distinctly stated in my lecture that the Select Committee recommended the conversion of these guns for the secondary purposes of defence. I will read what they state:—

"The Committee do not hesitate with these facts before them, to recommend an extensive conversion of our present cast-iron, smooth-bored guns into rifled guns, with linings of coiled iron for secondary purposes of defence. Experiments recently made, show the possibility of controlling the recoil of a gun of only 5 tons weight, when firing the full hammer charge of the 7-inch guns of 64 and 7 tons upon an ordinary 68-pounder wooden platform at 5° slope, strengthened and fitted with the American compressor, and although the Committee are not prepared to recommend such large charges for lined 68-pounders, they consider these experiments to have proved that such guns may, so far as the shock on the carriage and platform are concerned, be used on traversing platforms with charges beyond those appropriated to shell guns, and therefore be included in the list of guns for conversion, with a view to their employment for harbour defence in India or by any colonies that may desire so to utilize guns that are already colonial property. The Committee do not recommend them for coast and harbour defence at home, believing that, if this country is ever called upon to defend its shores, it will be against the most powerful ships and the heaviest guns that can be produced, and that its coast defences should be of corresponding efficiency; for the same reason, they should perhaps not enter into the armament of maritime fortresses of the first class, such as Gibraltar, Malta, Halifax or Bermuda; but there are probably many minor stations where they would be useful." I stated they were for secondary purposes of defence. It is not on account of their want of strength, but on account of their smallness of size that the guns were not recommended to compete with the heaviest guns that could be brought against them. With regard to the statement about the effect of the position of the vent, in the wrought-iron 68-pounders the vent entered 14 inches from the end of the bore.

Captain MORRIS: One. The other was 62. One of them was 36, and the other 43. I have got a note of them with me.

Major PAINMAN: Never mind; it does not matter. At all events, it is evident that whether it was 34 or 43 inches, it did not make much difference in the relative endurance of the two wrought-iron 68-pounders which bore. I would observe that my gun had slightly less windage than the wrought-iron guns; therefore, perhaps, a slight additional velocity would be due to that. And it was also a little bit longer, and that might also have made some difference; but not sufficient to account for this, that the initial velocity of my gun was 1,869 feet, while the initial velocity of

the wrought-iron gun was 1,270 feet per second. Furthermore, the gun beat the wrought-iron gun in every manner—in endurance, in range, and in accuracy.

Captain MOLONY: Will you permit me to say that no 64-pounder of the new pattern has ever been tried for velocity at all?

Major PALLISER: What is the position of the vent of the wrought-iron gun which was tested for velocity?

Captain MOLONY: The position of the vent is back.

Major PALLISER: What, through the cup?

Captain MOLONY: Yes; at least, I believe it is.

Major PALLISER: No 64-pounder wrought-iron gun has ever been vented through the cup. I wish, however, to point out one fact, that when you employ a very long charge of powder—(I am speaking with absolute certainty about this)—then the position of the vent becomes a matter of importance, because only a certain amount of the charge is inflamed at the first instant. These two guns that we were speaking about, were fired with only small charges of powder. Still, the position of the vent with such small charges of powder makes no difference. If you want to know the reason why my two guns lasted longer than the wrought-iron guns, I will give it you. The truth is this, that the wrought-iron guns were rifled with very sharp grooves; and in the grooves of my gun there was a small radius taken off. That little thing formed the nucleus of the beginning of the end of the wrought-iron guns were in a worse condition with regard to their grooves after firing 500 rounds, than my gun was after firing 2,000 rounds.

Captain MOLONY: Oh! so it was due to the rifling?

Major PALLISER: No matter; I claim that as a fact in favour of my gun. It was my own suggestion, and proved to be of great value.

Captain MOLONY: I have the figures now with respect to the position of the vent in those two guns. In one it was 3·7 inches, in the other it was 4·2 inches.

Major PALLISER: I may mention in reply, that there is a gun on board the "Excellent," that is vented in the same way, 3·7 inches from the end of the bore; and I have received a letter from Captain Hood stating that the gun has been firing 400 rounds, and is still in excellent condition. Then, it has been said that the wrought-iron portion of the gun which burst at Woolwich had not been deteriorated by the hot metal which had been cast round it. All I can tell you is, that many pieces of iron did draw out very well, but that some specimens snapped off short at 13 tons per square inch, showing that the iron had deteriorated.

Captain MOLONY: There were two pieces tested. One yielded at 11 tons to the square inch, broke at 19 tons, and stretched out 0·335. The specimen was only one and a half inch long.

Major PALLISER: Where was it cut from?

Captain MOLONY: It was cut from a piece where it was broken.

Major PALLISER: Whereabouts?

Captain MOLONY: It was a little piece. I cannot tell you exactly where it was cut from. The other piece that was tested yielded at 9·7 tons, broke at 11·4 tons, and stretched 0·51 inch, showing great uniformity with the other piece, which broke at 19 tons, and stretched out 0·335.

Major PALLISER: Do you know what the original strength of that iron was? It is Thornercroft's best, and the tensile strength goes up to 25 tons to the square inch. According to your own statement, you had breakage at 11 tons. What shows there was a deterioration even in those pieces amounting to 6 tons.

The CHAIRMAN: Has any other gentleman any observation to make, or any question to ask?

Captain HORTON, R.N.: May I be pardoned for asking a question, not for controversy, but for the purpose of obtaining information? It is with reference to the application of the tube force to a gun, a tube bored through. Two or three years ago, in Belgium, I learned from the then Minister of War, a man of science I believe, and certainly informed by a scientific body of artillerymen, that they had adopted the theory that the discharge of powder caused vibrations through the length of the tube, which, if the tube were not closed at the breech, and passed off as well there as at the muzzle. I must explain that they use the Krupp-system of stopping a breech-loading gun. The bursting of a gun takes place, I believe, almost universally

	68-prs. of 95 cwt.	10-inch guns of 84 cwt.	8-inch guns of 65 cwt.	32-pounders.			24-pounders.	
				63 cwt.	58 cwt.	56 cwt.	50 cwt.	48 cwt.
In the Land Service, 1864.	891	160	780	108	177	1,075	506	223
In store at Woolwich, 1865	389	141	290	18	340	338	480	478

That disposes of the statement that the recommendation of the Committee was limited to only guns of certain natures, since the heaviest cast-iron guns in the service, namely 68-pounders and 10-inch shell guns, are recommended for conversion.

Captain MOLONY: But there are no 68-pounders for this year at all events.

Major PALLISER: I took down your remarks, "the recommendation of the Select Committee was limited to certain guns." With regard to steel barrels, I distinctly said that I did not allude to a steel barrel which was bound up with super-imposed coils of wrought-iron. I alluded to steel barrels as compared with wrought-iron barrels for the purpose of converting cast-iron guns. I do not wish to enter into the discussion as to the relative merits of guns which are tied round with super-imposed pieces of iron. Then, with regard to the guns converted being for the secondary purposes of defence, I distinctly stated in my lecture that the Select Committee recommended the conversion of these guns for the secondary purposes of defence. I will read what they state:—

"The Committee do not hesitate with these facts before them, to recommend an extensive conversion of our present cast-iron, smooth-bored guns into rifled guns, with linings of coiled iron for secondary purposes of defence. Experiments recently made, show the possibility of controlling the recoil of a gun of only 5 tons weight, when firing the full battering charge of the 7-inch guns of 6½ and 7 tons upon an ordinary 68-pounder wooden platform at 5° slope, strengthened and fitted with the American compressor, and although the Committee are not prepared to recommend such large charges for lined 68-pounders, they consider these experiments to have proved that such guns may, so far as the shock on the carriage and platform are concerned, be used on traversing platforms with charges beyond those appropriated to shell guns, and therefore be included in the list of guns for conversion, with a view to their employment for harbour defence in India or by any colonies that may desire so to utilize guns that are already colonial property. The Committee do not recommend them for coast and harbour defence at home, believing that, if this country is ever called upon to defend its shores, it will be against the most powerful ships and the heaviest guns that can be produced, and that its coast defences should be of corresponding efficiency; for the same reason, they should perhaps not enter into the armament of maritime fortresses of the first class, such as Gibraltar, Malta, Halifax or Bermuda; but there are probably many minor stations where they would be useful." I stated they were for secondary purposes of defence. It is not on account of their want of strength, but on account of their smallness of size that the guns were not recommended to compete with the heaviest guns that could be brought against them. With regard to the statement about the effect of the position of the vent, in the wrought-iron 64-pounders the vent entered 3¼ inches from the end of the bore.

Captain MOLONY: One. The other was 6.3. One of them was 3.6, and the other 6.3. I have got a note of them with me.

Major PALLISER: Never mind; it does not matter. At all events, it is evident that whether it was 3¼ or 6½ inches, it did not make much difference in the relative endurance of the two wrought-iron 64-pounders which burst. I would observe that my gun had slightly less windage than the wrought-iron guns; therefore, perhaps, a slight additional velocity would be due to that. And it was also a little bit longer, and that might also have made some difference; but not sufficient to account for this, that the initial velocity of my gun was 1,350 feet, while the initial velocity of

the wrought iron gun was 1,270 feet per second. Furthermore, the gun beat the wrought-iron gun in every manner—in endurance, in range, and in accuracy.

Captain MOLONY: Will you permit me to say that no 64-pounder of the new pattern has ever been tried for velocity at all?

Major PALLISER: What is the position of the vent of the wrought-iron gun which was tested for velocity?

Captain MOLONY: The position of the vent is back.

Major PALLISER: What, through the cup?

Captain MOLONY: Yes; at least, I believe it is.

Major PALLISER: No 64-pounder wrought-iron gun has ever been vented through the cup. I wish, however, to point out one fact, that when you employ a very long charge of powder—I am speaking with absolute certainty about this)—then the position of the vent becomes a matter of importance, because only a certain amount of the charge is inflamed at the first instant. These two guns that we were speaking about, were fired with only small charges of powder, 8 lbs.; the position of the vent with such small charges of powder makes no difference. If you want to know the reason why my two guns lasted longer than the wrought-iron guns, I will give it you. The truth is this, that the wrought-iron guns, were rifled with very sharp grooves; and in the grooves of my gun there was a small radius taken off. That little thing formed the nucleus of the beginning of the end; the wrought-iron guns were in a worse condition with regard to their grooves, after firing 500 rounds, than my gun was after firing 2,000 rounds.

Captain MOLONY: Oh! so it was due to the rifling?

Major PALLISER: No matter; I claim that as a fact in favour of my gun. It was my own suggestion, and proved to be of great value.

Captain MOLONY: I have the figures now with respect to the position of the vent in those two guns. In one it was 3·7 inches, in the other it was 6·2 inches.

Major PALLISER: I may mention in reply, that there is a gun on board the "Excellent," that is vented in the same way, 3·7 inches from the end of the bore; and I have received a letter from Captain Hood stating that the gun has been firing 400 rounds, and is still in excellent condition. Then, it has been said that the wrought-iron portion of the gun which burst at Woolwich had not been deteriorated by the hot metal which had been cast round it. All I can tell you is, that many pieces of iron did draw out very well, but that some specimens snapped off short at 13 tons per square inch, showing that the iron had deteriorated.

Captain MOLONY: There were two pieces tested. One yielded at 10 tons to the square inch, broke at 19 tons, and stretched out 0·335. The specimen was only one and a half inch long.

Major PALLISER: Where was it cut from?

Captain MOLONY: It was cut from a piece where it was broken.

Major PALLISER: Whereabouts?

Captain MOLONY: It was a little piece. I cannot tell you exactly where it was cut from. The other piece that was tested yielded at 9·7 tons, broke at 19·4 tons, and stretched 0·51 inch, showing great uniformity with the other piece, which broke at 19 tons, and stretched out 0·335.

Major PALLISER: Do you know what the original strength of that iron was? It is Thorneycroft's best, and the tensile strength goes up to 25 tons to the square inch. According to your own statement, you had breakage at 19 tons. That shows there was a deterioration even in those pieces amounting to 6 tons.

The CHAIRMAN: Has any other gentleman any observation to make, or any question to ask?

Captain HORTON, R.N.: May I be pardoned for asking a question, not for controversy, but for the purpose of obtaining information? It is with reference to the application of the tube form to a gun, a tube bored through. Two or three years ago, in Belgium, I learned from the then Minister of War, a man of science I believe, and certainly informed by a scientific body of artillerymen, that they had adopted the theory that the discharge of powder caused vibrations through the length of the tube, which, if the tube were not closed at the breech end, passed off as well there as at the muzzle. I must explain that they use the Krupp-system of stopping a breech-loading gun. The bursting of a gun takes place, I believe, almost universally

at the seat of the powder-charge. Two guns, precisely similar, were adopted for experiment in Belgium—small guns cast in brass. One was left in its normal condition, the other was bored through, and employed in that way as a breech-loader; and the two were experimented upon in order to obtain this information. The gun in its normal condition burst at the 29th round, while the other went on so continuously that the authorities did not care to carry on the experiment any longer; it was assumed that a gun treated in that way was very much stronger than the other. They were induced to continue their practice up to the 68-pounder gun. They were under the impression that the system of loading at the breech was very much more important with larger descriptions of ordnance than with smaller ones; in short, it was their determination to go on from the point at which we appear to have left off in the attempt to load at the breech. I ask this question of Major Palliser, if he will be kind enough to answer from his experience, whether he is of opinion that that system would be applicable to other descriptions of ordnance, either built upon this or any other method, as well as the class of guns I have spoken of, cast in brass. I ask this because it appears to me of great importance, in the present day, when we have ships carrying 9 inches of iron,—it appears to me to be the duty of ships to engage forts from a short distance, to batter them in breach. In short, I believe we shall come to that. There is no reason to the contrary. Let a ship be made as nearly invulnerable as she is in the present day, provided with turrets and proper ordnance, it will be her duty to engage forts instead of trying to slip past them. How are we to do that? I look upon the Americans as practical and very well informed in matters of gunnery. They adhere very steadfastly to the system of spherical shot. I believe they are right. The spherical shot would be the missile to employ, delivered at short ranges and high velocity, for the purpose of breaking down iron shields, or destroying the embrasures of forts; and that system would be best applicable in combination with breech-loading. Therefore the question appears to me to be one of very great importance, not to makers of guns only, but also to both Services. I, therefore, wish to raise the question here.

Mr. MALLEY, C.E., F.R.S.: I beg to make one or two remarks. Perhaps I may commence by stating what probably would be a sufficient answer to the question just put; namely, as to whether open breech-tubes are not stronger than closed breech-tubes. Herr Scheffler, a German mathematician, in several papers has rigidly investigated all questions that relate to the expansion of ringed or hooped tubes analogous to those of cannon, and has conclusively proved the enormous superiority in resistance of the closed tube to the breech-loading or open-ended tube. His memoir has been translated by myself, and will be found in the *Practical Mechanics' Journal*. With respect to the paper which we have just heard, I would venture to make one or two remarks. I shall not attempt to go into the general subject, because it is one that involves almost every debated question in respect to the construction of guns, and this is not the proper audience to discuss that. I must regret, as a civil engineer, that Major Palliser does not come to the Institution of Civil Engineers in Great George Street, and fairly put himself into the arena, where he would have to ventilate his ideas and compare them with those of others competent to discuss their merits or demerits. Here he has it pretty nearly all his own way, because there are very few gentlemen in this Institution capable of dealing with questions such as these. I myself at this moment I believe stand alone here as a civil engineer. Now, with respect to what I have heard about the superiority of wrought-iron 10-lb. coiled tubes, as compared with steel tubes, every one who has read what I have written on the subject of iron ordnance, knows that I have been an advocate for wrought-iron coiled tubes; I was one of the first to prove that wrought-iron coiled tubes must be better than the common lap-welded or "skelp"-welded as they are called, or solid bored out tubes, in the proportion of 7 to 1. The argument which I have heard to-night that steel tubes are better than those of wrought-iron, seeming to rest wholly upon the view that the latter are degraded to a greater extent by the blast of powder passing than the wrought-iron tube is.

Captain MOLONY: It is not so in every case.

Major PALLISER: When wads are not employed.

Mr. MALLEY: I can only say that in all cases that have come before my eyes, degradation has been somewhat greater with steel than with wrought-iron. And I

may mention that I have had the opportunity of examining the matter closely, because about a year ago or more, I, in concert with Dr. Percy, was called upon to examine the tubes of 9-inch guns that were seriously degraded; some of wrought-iron, coiled, and some of steel. We found the steel was rather more degraded than the wrought-iron; but the difference was so slight, that to base an argument upon that in favour of wrought-iron is perfectly absurd. Let me just remark this. If these steel tubes are so bad, and the wrought-iron ones are so good, is not that a logical cutting away of the basis from under Major Palliser's method of construction altogether? Major Palliser's method, to speak to untechnical apprehensions, is this: that he puts an india-rubber ring outside a glass tube in order to strengthen that tube. That is to say, he puts a wrought-iron tube outside a cast-iron outside. Now, the wrought-iron tube is more extensible than steel, but it is also less extensible than the cast-iron tube outside.

Major PALLISER: No.

Mr. MALLET: I assert as a fact that within the limits of a strain of four or five tons to the square inch, which is all you can get out of the best cast-iron that can be made, the extension per ton per square inch considerably exceeds that of wrought-iron. If that be so, I say Major Palliser's construction is altogether based upon a fallacy. You see the fallacy brought to its *reductio ad absurdum* in that gun, (pointing to the diagram of the burst Palliser gun), which seems to me to be a complete condemnation of the whole system of cast-iron put on over wrought-iron. I may remark that all this business that makes so much noise seems to me to lack novelty altogether. It is at least 150 years old. The celebrated Reaumur, in an original paper which he presented to the Royal Academy of Sciences, suggested—M. Villons and other makers having failed to make wrought-iron guns on much the same system which Treadwell in America has brought up again—Reaumur suggested the idea of making a wrought-iron tube, making it by coil, and putting it inside a cast-iron gun. The Marquis de Courtivron and M. de Bouchu both French iron-masters, between 1755 and 1780, both re-produced the same idea. Monge, the celebrated author of the "*Géométrie Descriptive*," reproduced the same idea in 1813, after the disasters of the Russian campaign, when the French artillery was gone, and the question was how it was to be restored in a few months. There is nothing new in the idea of putting a wrought-iron tube inside a cast-iron gun. I fail to see the merit of the scheme in point of novelty, and I fail to see the merit of it in a practical point of view. I must say, having myself no holy reverence for the recommendation of an Ordnance Select Committee, nor yet any disrespect for them, that the mere fact that they have recommended guns to be converted in this way, fails to convince me that it will not be a positive national disaster if any considerable number of our guns be converted on any such a system. In support of that, I can do no more here than venture a bold assertion; I say upon that system you will never have a safe gun. I say further, that you will never make any gun that exists in the British service, when so converted, a useful gun. There is not one of the great military powers of Europe at the present moment that has not seen the fact, that whenever the tug of war comes, the smooth-bore will come into action again. The Prussians have not even abandoned their smooth-bore field batteries. I say no smooth-bore gun in the British service ought to be destroyed except below the calibre of an 18-pounder. Then, as regards the 32-pounders and the larger guns, keep them smooth-bores as they are, and you will find a real use hereafter for them. Attempt to convert them upon this plan, and you will simply destroy them as smooth-bores, and you will make them perfectly useless for any purpose, because too small; and utterly untrustworthy as rifles.

The CHAIRMAN: Do you wish to reply, Major Palliser?

Major PALLISER: I must say before replying, that I think it is scarcely fair to a man, not much given to public speaking, to have to jump up and reply at score to a carefully prepared attack by a well-known man like Mr. Mallet. I rather deprecate it, that in the discussions in this place, one is rather put up as a target for every one to have a shot at.

Mr. MALLET: Allow me to assure you that until I came into this room I had not the slightest idea of saying one word. It was not until four o'clock to-day that I knew you were going to deliver this lecture, and not one word that I have said was prepared.

Major PALLISER: After that statement will you answer one question? There has been such a remarkable similarity between your remarks and remarks that have appeared in newspapers, that I ask you, are you the author of the article that described me as "a man with a maggot in his head?"

Mr. MALLET: I am not the author of any article that called you "a man with a maggot in his head."

Major PALLISER: Or "a maggot in his brain?"

Mr. MALLET: I never used such an expression with respect to you, and, as a gentleman, I should never use such an expression as to any one. That is my negative answer. My positive reply is, I am the author of several articles in the *Engineer*, on Artillery, and, among others, of one upon the subject of your guns.

Major PALLISER: That is the article I allude to. It describes me as "a man with a maggot in his head."* At all events, your having acknowledged that you are the author of an article in the *Engineer* writing down my gun, shows that you are not unprepared to take part in this discussion, because you have repeated to-night many of the observations that appeared in that article, verbatim. For instance, the expression about putting wrought-iron inside cast-iron being like putting glass inside india-rubber. If you look at the patent I took out in 1862, you will see that I distinctly distinguish between the qualities of elasticity and extensibility. There is no term which I have seen more confounded than the term "elasticity." "Elasticity" is very often used in common parlance as the quality which represents the amount a thing can stretch. It is not. Elasticity is that power which a substance has to revert back to its original shape. Extensibility, on the other hand, is the quality which a tough body has of being drawn out without any reference to returning to its original form. I said that wrought-iron by its extensibility was able to excite and call to its assistance the strength of the surrounding portions of the metal. This has been conclusively proved by experiments, and here is the gun that I have tried it upon. I fully admit, on the other side, that if you expose a wrought-iron tube to the continuous test of excessive firing, you will eventually split the tube. But as long as that tube is new and not worn out, I defy you to burst the tube inside the casing of cast-iron with any charge that a wrought-iron gun will resist. I wish to say one thing more, which I forgot at the time. It is stated that my gun is vented at the end near the breech. I beg to state that my gun at Shoeburyness is not vented at the end; it is vented $4\frac{1}{2}$ inches from the end. In addition to that, I was not satisfied with the 8-inch rifle-converted gun firing 30 lbs. powder and 180 lbs. shot by means of a rear vent, but I pierced the gun with a second vent, $8\frac{1}{2}$ inches, from the end of the bore; I fired ten rounds with 30 lbs. powder as before, and 180 lbs. shot, and when I took the expansions of the gun, they amounted to nothing. With regard to extensibility, Mr. Mallet seems to think that Military men are not capable of expressing an opinion upon the properties of iron; that a man must be a Civil Engineer to be able to do so. I beg to say that I have gone through a course of study on these subjects quite equal to that of any Civil Engineer. Now, I wish to point out, that if you take a piece of soft iron which breaks at 22 tons to the square inch, and if you take the strength per fractured area of that iron, you will find it is nearly as strong as the strength per fractured area of steel. Therefore, I say that a cast-iron gun lined with a wrought-iron coiled barrel will bear an enormous amount of strain before it gives way; and further, the expansions are so very small in the gun, that the limits of extensibility of wrought-iron are never approached. The best proof I can give is that my 9-inch gun only expanded $\frac{1}{15}$ ths of an inch; that that expansion took place in the first few rounds; and that the subsequent 500 rounds expanded it but very little, and that the barrel of a lined gun

* Mr. Mallet claims permission to place here on record, that in nothing that he has ever written has he ever used the discourteous expression here again attributed to him by Major Palliser—after his denial of it. Mr. Mallet knows nothing of expressions that may or may not have been employed by other writers in the *Engineer* on artillery. He denies having any prejudice, or having ever attempted to "write down Major Palliser's gun" in any way but by stating fairly the objections to it, as apparent to him.—13th November, 1868, R. M.

expanded more than half an inch without bursting, when the casing gave way. With regard to what constitutes an original invention, I would state that it is not the man who merely suggests that a thing may be done, but the man who patiently works at it until he shows how it can be done, who is the inventor. I might suggest that you might propel a railway train by galvanism, but if I did nothing more than that, I could not claim to be the inventor of a galvanic locomotive engine. With regard to the recommendations of the Ordnance Select Committee, which Mr. Mallet does not seem to value, I have to say, give me as judges practical men, gentlemen, unprejudiced men, who will be guided in their decisions by the practical results of experiments; and not men who have preconceived opinions, no matter what their professional education may be. Something was said about smooth-bore guns. I would merely remark that the new calibre of the converted 64-pounder is exactly the same that it was before, so that if you wish to fire a round shot out of that gun you can do so, and put in much more powder than before. The great mistake that I made with regard to chilled shot was in the name which I gave them. Had I given them a good distinctive name, my originality would never have been questioned. If I had called them "refined iron shot," nobody would have objected to the term; but, unfortunately, because I produced refined iron shot in the chilled shape, and because none had been previously chilled in the mould, an objection was made. Mr. Gruson, of Magdeburg, is very much written up in the *Engineer*. I admit that his shot were chilled; his shot were partially chilled shot with bluffs, while mine are, and always were chilled pointed shot. Last week an English gun was taken to Berlin, and was tried against a Prussian gun. The English gun was fired with 43 lb. charges and 250 lbs. projectile; the Prussian gun was fired with 45 lbs. powder, and the weight of its projectile was 320 lbs. I was informed that the English, *i.e.*, my shells went completely through the target at 500 yards, and that the Prussian shells stuck in the target.

The CHAIRMAN: I do not know whether any other gentleman wishes to address the meeting. If not, I will make a few observations as Chairman.

Mr. MALLET: Am I precluded from making one or two remarks with regard to elasticity or extensibility?

The CHAIRMAN: Is it applicable to the subject before us?

Mr. MALLET: It is directly applicable. Anything that I have said as regards the relations between wrought iron internal tubes and cast iron external ones, will apply equally well, whether you use the terms elasticity or extensibility. All that elasticity means, as regards such questions as we have before us, namely lineal elasticity, is simply how much a thing that is pulled out shall go back again. Within certain limits everything that is pulled out will go back. Those are called the limits of its elasticity. If a thing is pulled out beyond those limits, it ceases in so far to be elastic, it will not go back again. Therefore, you may as well call it elasticity as extensibility, because the difference, if any, depends simply upon the degree to which the thing is pulled out.

Major PALLISER: May I make one remark? I interrupt you for one moment. You instanced glass as representing my coiled barrel. Now, it so happens that glass is the most elastic substance that we have. If you drop down a glass ball 15 feet, I believe it will bound up 13 feet; therefore its co-efficient of elasticity may be represented as 13 divided by 15—perfect elasticity being represented by unity.

The CHAIRMAN: Captain Horton has not received a reply from you about open tubes.

Captain HORTON: My question is, whether a gun is stronger for being an open tube at the rear, so that it can be employed as a breech-loader to propel round shot at high velocities, than being closed at the end and used as a muzzle-loading gun? I am speaking of guns of large size, and I ask whether you think the system of breech-loading is not applicable to guns on a large scale, rather than to those of smaller dimensions?

Major PALLISER: I quite agree with you that the great desideratum is to obtain a good breech-loader. And I also agree with Mr. Mallet, that in the Prussian system of breech-loading, that form of strain acts no further than where you cut the barrel off. There is not the help and assistance to the arch that there is here; therefore, a tube cut off flush, like the Prussian tube is, must be weaker. On the

other hand the French have obtained very astonishing results with their breech-loaders. However, they eventually become muzzle-loaders. The breech screws right up into the bore; so that I think the French are working in the right direction for a breech-loader. But until we can get a breech-loader that is so absolutely reliable, that in the heat and hurry of action a man cannot put it out of order, I think it is far safer to retain the present muzzle-loader.

The CHAIRMAN: I must say that, viewing as I do, apart from all personal or interested considerations, the papers which Major Palliser has read in this Institution, they appear to me to have this practical value, that they set forth to us in clear, intelligible, and in fair language the progress of his inventions, their processes and their failures, as well as their successes. I think we owe to him our thanks for what he has favoured us with this evening, as much for the description of those guns formed with wrought-iron cores and cast-iron bodies over them, as for the description of those remarkably successful guns which are manufactured by the insertion of a wrought-iron tube into a cast-iron gun already in existence. The experiments which have produced these results, are as valuable in regard to failures, for they point out to us errors that ought to be avoided, as they are in reference to their successes. I do hope that, as the Government acknowledged Major Palliser's eminent services in the invention, if I may so use the term, or rather in the development of the invention of the refined white iron shot, so he will not be allowed to be a loser by those valuable results, which have proved that cast-iron over a wrought-iron core is not a construction that can be safely used. With regard to the second method by which wrought-iron tubes are introduced into cast-iron guns already formed, I speak from memory, but I think in a paper read here last year, Dr. Twissden showed, that a construction of that kind gives a gun double the strength which it had before; whereas wrought-iron coiled over a cast-iron gun does not increase the strength of the gun perceptibly; that is, the difference is small in the ratio of 176 to 170. As regards the two principles of ordnance, that which we adopt secures penetration and long range, compared with the American system, which is that of smashing at short distances. It was told us a few evenings ago in this theatre by a gentleman, whose paper was received with the greatest applause, Captain Hamilton, that our Cousins across the water, who certainly are individually as clear-headed as most men, and nationally as clear and far-seeing as most nations, were giving up their heavy, large-diameter spherical shot, their Rodmans, Columbiads, and Parrott guns, and that they were introducing a compound gun, such as we are now making. I think we may be proud of our countryman, Major Palliser, and that the Institution owes him a great deal for having made this Theatre the arena for expounding his principles. *His name will be forever associated in history as one of the great pioneers in the improvement of artillery. Speaking myself as an unprejudiced man, the experiments which he has described with the guns, constructed with wrought-iron cores let into cast-iron bodies, have to my mind carried conviction with them; and I have no doubt, that as his great experimental knowledge and practice enable him to go on, we shall not suffer in the end from not having trustworthy guns for secondary purposes of defence. I believe we have already got trustworthy guns, and that we shall probably have those which are more so. In experiments in the mechanical arts, it is not possible for any nation to retain exclusively that which they invent. The progress of science has made such great advances, intercommunication of ideas, is so easy, and the means of communication especially by the Telegraph are so expeditious, that what one nation invents, another nation can easily and at once appropriate. Therefore, we cannot expect to hold our own inventions exclusively either with regard to guns, or with regard to shot. Other nations will adopt them. But there is one thing they cannot do; they cannot deprive Major Palliser of the credit of his inventions, which have been advanced step by step on the basis of a practical experience gained as he has gone on. Neither can any other nation, as in the case of Captain Cook, claim a joint nationality in Major Palliser. We claim him as our own, as we also claim the merit of his inventions also. I am sure I only express the feelings of this meeting, when we offer him our warmest thanks for the pains he has taken in explaining to us this evening the principles on which he has carried on his experiments.

